TASCAM

TEAC Production Products

58

8-Track Recorder/Reproducer

OPERATION/MAINTENANCE

5700039301

The guarantee of performance that we provide for the 58 must have several restrictions. We say that the recorder will perform properly only if it is adjusted properly and the guarantee is that such adjustment will be possible. However, we cannot guarantee your skill in adjustment or your technical comprehension of this manual. Therefore, Basic Daily Setup is not covered by the Warranty. If your attempts at internal adjustments such as rebias and record EQ trim are unsuccessful, we must make a service charge to correct your mistakes.

Recording is an art as well as a science. A successful recording is often judged primarily on the quality of sound as art, and we obviously cannot guarantee that. A company that makes paint and brushes for artists cannot say that the paintings made with their products will be well received critically. The art is the provice of the artist. TASCAM can make no guarantee that the 58 in itself will assure the quality of the recordings you make.

Your skill as a technician and your abilities as an artist will be significant factors in the results you achieve.

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

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OPERATION/MAINTENANCE

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Note:
If you notice any differences, either on the outside or the inside of the unit from the illustrations and descriptions in this manual, talk to your dealer. He may have revision sheets that will show manufacturing changes, or notifications of how to deal with any changes in set-up or maintenance procedures.
Save this manual, refer to it when necessary, and good luck with your 58.

*dbx is a trademark of dbx Incorporated. dbx noise reduction system manufactured under license from dbx Incorporated.

This recorder/reproducer has a serial number located on the rear panel. Please record the model number and serial number and retain them for your records.
Model Number ____________
Serial Number ____________

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Model Number ____________________

Serial Number ____________________

1. GENERAL INFORMATION

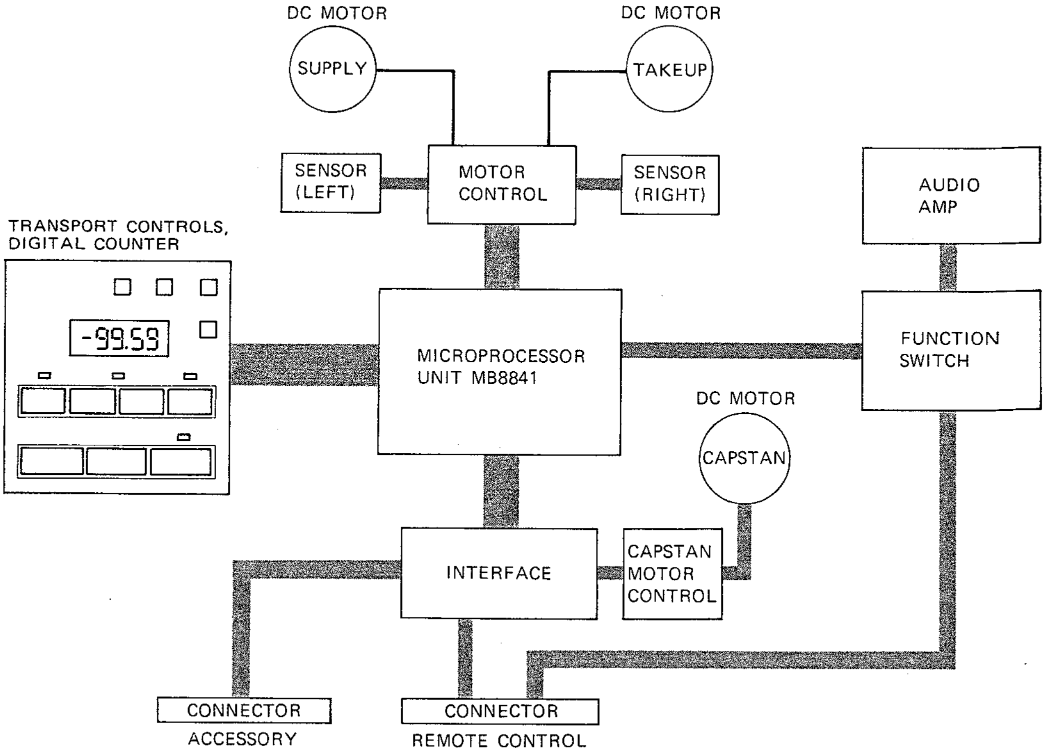
This manual contains operation and maintenance information for the TASCAM 58 Tape Recorder/Reproducer.

1-1. GENERAL DESCRIPTION

The 58 is an exceptionally versatile high-performance 8-track, 8-channel multitrack tape recorder/reproducer that uses 1/2 inch wide tape and operates at 15 ips (38 cm/sec). The head configuration consists of an erase head and two record/reproduce heads, one of which is used for recording and sync playback, and the other of which is used for playback only. This is an advantage primarily during alignment, since sync response is equal to repro response.

Designed especially for demanding production applications, including lock-up to SMPTE* controller/synchronizers, the 58 transport is built on a new, extra heavy duty chassis. The chassis includes a rigid aluminum base plate that ensures stable tape motion and stable alignment despite the long hours of high speed, start-stop shuttling that are typically part of editing (especially when locked up to film or video systems). The 58 is quick enough to keep up with your tight deadlines. Tape motion is fast, smooth, and accurate thanks to a built-in microcomputer which commands two direct drive reel motors under full tension servo-control and an FG servo-controlled capstan motor.

*SMPTE is the Society of Motion Picture and Television Engineers; this reference is to an 80-bit digital code developed by SMPTE and used to designate the exact location (in hours, minutes, seconds and frames) on a film, video tape, or audio tape. Suitable equipment can synchronize ("lock up") two or more machines by using the SMPTE time code recorded on each.


DC MOTOR
SUPPLY
DC MOTOR
TAKEUP
SENSOR (LEFT)
MOTOR CONTROL
SENSOR (RIGHT)
AUDIO AMP
TRANSPORT CONTROLS, DIGITAL COUNTER
-99.59
MICROPROCESSOR UNIT MB8841
FUNCTION SWITCH
DC MOTOR
CAPSTAN
INTERFACE
CAPSTAN MOTOR CONTROL
CONNECTOR
ACCESSORY
CONNECTOR
REMOTE CONTROL

The 58's electronics are mounted on plug-in printed circuit boards for ease of service. Access for routine alignment is provided through the front of the machine; the VU meter panel swings out and down for easy access to the EQ, bias and level calibration trimmers. This facilitates alignment while observing the results on the meters. Alignment is equally easy whether the 58 is housed in a vertical equipment rack, in a roll-around console, or on a desk. (More information on these adjustments is provided in the "Maintenance" section of this manual.)

The 58 includes a variety of functions and features that are essential to high-speed professional audio production. Naturally the basics of synchronous recording and playback are provided, with separate OUTPUT SELECT, pre-load (SYNC/INPUT) and REC function switches for each track. A digital fluorescent tape counter is tach driven, displaying elapsed time in minutes and seconds, or "negative" real time if prior to the zero point. A built-in auto locator function utilizes the digital tape counter and microprocessor to memorize a specific point on the tape; a single button then commands the transport to search (in either direction) for that cue. Another button commands a search to counter zero (again, either forward or reverse winding to the 00.00 point). Record/repro speed is adjustable for gross corrections or fine tuning by means of a PITCH CONTROL that has coarse (±15 %) and fine (±0.7 %) adjustments. An optional full remote control is available for performing all functions at a distance from the machine, except edit mode. Manual and dump editing are possible, and a splicing block is conveniently mounted on the front panel. In order to get a tight, uniformly packed reel for storage, it is not necessary to wait while off-loading a tape in play mode. Instead, tape may be rapidly wound onto the takeup or supply reel in a high-speed spooling mode that avoids the loose or uneven tape pack which is typical of many servo-controlled systems. Other features include a dbx** connector (DBX UNIT CONTROL SIGNAL) for plug-in compatibility with a TEAC-built dbx tape noise reduction system, a remote control connector (REMOTE) for interfacing with the optional RC-51 or RC-50 remote control unit and a synclock connector (ACCESSORY) with the necessary output and input lines for plug-in compatibility with popular SMPTE controller/synchronizers.

**dbx is the registered trademark of dbx Incorporated, Newton, Mass.

1-2. TAPE TRANSPORT

Mounted on a rigid, precision-machined aluminum base plate are the main transport components, including: the supply and takeup reel motors, the capstan motor, the pinch roller, the tachometer roller, the digital counter, and the tape tension arms with their guide rollers.

All modes of operation, including fast forward, rewind and spooling, are commanded by the 58's specially programmed microprocessor controller. Tape tension is controlled by a full servo reel system. The FG (frequency governed) servo capstan motor ensures precise tape speed. The motor's large size, its brushless design, and the direct drive capstan on the end of the motor shaft all serve to minimize cogging and other speed variations while providing extended service life.

The tension servo employs a "non-contacting" detector, a photo-interruptor which senses the position of the tension arm so the servo can adjust the reel motor torque. Also, the servo adjusts tension arm position to further optimize tape tension. The reel motor servo system is very stable, and is not easily influenced by environmental conditions.

Major rotating components, including the tension arm guides and the pinch roller, are supported by ball bearings to provide minimum friction while retaining close tolerances. In fact, the tension arm itself is ball bearing supported for more sensitive response and greater motor and servo durability.

The tachometer roller measures linear tape footage, although the readout is converted to elapsed time from whatever zero point is entered. As tape moves, it turns the roller, causing a radially marked disk on the roller shaft (below the transport) to interrupt a photo sensor, which drives the digital counter circuitry. A thin rubber coating on the tach roller avoids tape slippage (for the most accurate results), and also protects the surface of the tape.

A solenoid-actuated tape lifter automatically pushes tape away from the heads during any of the fast winding modes, including fast forward, rewind, and spooling. This prevents unnecessary wear on the heads and tape, and avoids the disturbing loud, high-frequency sounds that could otherwise damage monitor speakers. For added protection, the 58 line outputs are also electronically muted. However, for editing, progressive engagement of the cue lever defeats the tape lifters so cues can be heard while fast winding.

1-3. HEAD ASSEMBLY

Access to the heads for cleaning or editing is provided by a flip-up head access cover, and a latching push-in head shield (head gate).

The assembly has three heads: erase, record/sync and repro, plus a scrape flutter filter (a precision roller between the record/sync and repro heads) and three fixed guides. The record/sync head and repro head are interchangeable, and adjustable (semi-fixed) for easy installation and removal. While either head is thus capable of recording, only the record/sync head is used for that purpose. However, either head will provide the same high-quality reproduction for playback. This means that artistic performance judgements and mixing decisions which are made during an overdub or an insert will be based upon the correct frequency balance (unlike machines with lesser sync playback response). Another advantage of the 58's high quality sync response is the ability to "ping-pong" or re-combine tracks, even during overdubs, without sacrificing audio quality.

1-4. ELECTRONICS

Strong emphasis has been placed on the audio quality of the 58's electronics. All amplifiers are direct coupled (DC) for lowest distortion and optimum low frequency response. The first stage of the reproduce amplifier consists of a pair of ultra-low noise FETs (field effect transistors). This differential amplifier eliminates the necessity of having to insert a coupling capacitor between the heads; instead, the DC servo amplifier brings the offset voltage to zero. The result is a smoother, wider frequency response with better transient and phase characteristics. The amplifier section is constructed using plug-in printed circuit boards. Connections between circuit boards are made via a mother board. Just four front panel screws need be removed to slide out the meter panel for access to electronic adjustments. The usual bias, level, and EQ trimmers are provided, with separate controls for SYNC and REPRO playback. The trimmers are all metal glazed to enhance mechanical durability and avoid susceptibility to environmental conditions. There is a master bias oscillator, plus a separate bias amplifier for each track. This avoids interactions through the bias circuit for quieter punch-in and punch-out operations (i.e., minimum "click" noise). Levels can be monitored via 8 VU meters that incorporate peak indicating LEDs. The VU meters provide a familiar "average" level reference by which loudness can be judged, while the peak LEDs respond to brief transients that might not show on the meters, allowing the operator to avoid tape saturation.

1-5. POWER SUPPLY

The 58's power transformer is factory adjusted for various line voltages prior to shipment, depending upon where the machine is to be sold. The following standards are used:

European models:	220 V, 50 Hz
U.K./Australian models:	240 V, 50 Hz
U.S.A./Canadian models:	120 V, 60 Hz
General Export models: (switchable voltage)	100/120/220/240 V, 50 or 60 Hz

The front panel switches are electro-mechanically linked with the following power supply circuits:

1. A regulated bipolar 15 volt DC (nominal) supply for the audio amplification circuitry. This ±15 volt supply includes an exclusive tracking filter circuit to eliminate AC ripple.
2. +15 volt DC and +5 volt DC (nominal) supplies for the microprocessor and related logic circuitry.
3. A +24 volt DC (nominal) supply for the reel motors.
4. A +24 volt DC (nominal) supply for the capstan motor and the relay which switches the amplifiers. This supply is independent of the reel motor 24 volt supply.
5. A +5 volt DC supply to the capstan servo system.
6. Two DC voltages for the pinch roller solenoid: a higher voltage (+24 V) is used initially to

ensure the strong, positive actuation of the solenoid. Once engaged, the solenoid is held in place by a lower voltage (+15 V) which thereby avoids generation of excess heat. The 15 volt "holding" current is passed through a ripple filter to avoid any chance of mechanical buzz, and to avoid any chance of hum leaking into the audio amplifiers.

7. A 6 volt AC (nominal) supply for illumination of the VU meters. The microcomputer also uses this supply voltage to detect when the power is turned on or off to activate the muting circuit, and when the central processing unit erroneously functions or when the power is cut off during the rewind or fast-forward modes, this supply circuit serves so that the deck will go automatically into the stop mode as a safety precaution.

1-6. REMOTE AND OUTPUT CONTROL FUNCTIONS

1. REMOTE Control

a) The REMOTE on-off switch, when on, activates the RC-51 Full Function Remote Control and permits transfer of the OUTPUT SELECT, REC and pre-load (SYNC/INPUT) functions from the 58 to the RC-51. The switch has no effect on the transport controls: even when off, the transport controls (except EDIT), auto locator (CUE, STC, RTZ), digital counter and RESET functions can always be remote-controlled from the RC-51 as well as the RC-50 Transport Remote Control Unit. In record or record/pause mode, a momentary muting circuit prevents clicks from reaching the 58 line output while the REMOTE switch is operated.

b) If the 58 is in the record/pause, record ready or record mode, it will automatically enter stop mode if the REMOTE on-off switch is operated. This avoids the chance of accidental tape erasure in the event of improper remote unit or transport function switch settings.

2. OUTPUT SELECT Pushbutton Switches

a) There are three OUTPUT SELECT pushbuttons: INPUT, SYNC and REPRO. These switches determine the source of the audio which appears at the 58 line outputs, as explained below.

b) Pressing the INPUT button feeds the 58 line outputs with the same signals applied to the line inputs. Pressing the REPRO button feeds the 58 line outputs with a signal played back from the tape via the repro head. Pressing the SYNC button will feed one of two signal sources to the line outputs, depending on the setting of the pre-load (SYNC/INPUT) switches and on the record or play status of the transport: the input to the machine, or sync playback from the record head. For further details, refer to "4-3. Monitoring the Line Outputs", page 4-2.

1-7. TRANSPORT CONTROLS

1. Auto Locator Functions
   There is a built-in auto locator function which permits automatic searching to a precise location on the tape for convenient replay, copying, overdubbing, editing, etc. The auto locator relies upon the tape counter, and provides two search points: one is the zero point, and the other is a designated cue point. Pressing the RTZ button (Return To Zero) causes the transport to rewind or fast forward wind the tape to 00.00 and stop. Pressing the STC button (Search To Cue) causes the transport to rewind or fast forward wind the tape to whatever point was earlier designated as a cue, and then stop. (Note: the cue point is originally designated by pressing the CUE button when the tape is stopped at or moving past the desired location.)
2. Stop Mode
   When the tape enters stop mode at the end of RTZ or STC search operations, or after a rewind or fast forward wind, the reels are slowed to a stop by means of dynamic braking. This application of opposite electrical torque to the reel motors stops the tape more gently than mechanical braking; it avoids slippage and stretching by maintaining a more constant tension throughout the deceleration.
3. Fast Forward, Rewind and Spooling Modes
   Pressing either the (▸▸) or (◂◂) button once causes the tape to run rapidly in the designated direction. Pressing the button a second time causes the unit to enter spooling mode (tape runs at an intermediate speed).
4. Play and Related Modes
   Pressing the play (▸) button from stop mode causes the transport to run forward at 15 ips (fixed speed mode) or whatever constant speed has been set with the PITCH CONTROL. Pressing play (▸) while the

unit is in fast forward or rewind mode causes the tape to come to a stop and then immediately enter play mode.

5. Record Mode
   Pressing the play (▶) and RECORD buttons together places the transport in record mode, although recording does not actually occur unless one or more REC function switches have also been set to record ready status. If tape is already playing, pressing play (▶) and RECORD accomplishes a punch-in. Punch-out (ending recording while still rolling tape) is accomplished by simultaneously pressing play (▶) and RECORD a second time. (Pressing the play button alone will not stop the recording process). Recording can also be stopped by pressing STOP, ▶▶ , ◀◀ , STC or RTZ.
6. Edit Modes
   Pressing the EDIT button releases the reel brakes and sets the reel servo system so that very little tension is held. This permits reels to be manually turned in either direction while listening (or looking) for a precise cue point on the tape. Tape can be "dump edited" by simultaneously pressing the play (▶) and EDIT buttons. In this mode, the capstan pulls tape past the heads, but the takeup reel motor does not operate. Cancel the dump edit mode by pressing STOP.
7. REMOTE Control Connector
   There is a multipin REMOTE connector on the 58 rear panel. It interfaces with either RC-50 or RC-51 optional remote control. The RC-50 Transport Remote Control Unit provides basic record, play, stop, pause and fast winding control, plus it has a digital counter readout with RESET button, CUE, STC and RTZ buttons. The RC-51 Full-Function Remote Control Unit provides the basic functions of the RC-50, plus OUTPUT SELECT switches, and individual track selection buttons for record on/off (REC) and preload (SYNC/INPUT), allowing remote-control of all the 58 front panel functions, except the edit mode.
8. ACCESSORY Connector
   This connector is designed for interface with a BTX, ECCO, CONVERSION, FERNSEH, AUDIO KINETICS or similar synchronizer, and has the necessary logic and tally lines for proper control of the 58 by that unit.

1-8. MOTOR DRIVE CIRCUIT

The 58 is designed so that the tape tension on both reels is proportionally maintained while the system is in play mode. During the fast winding modes, back tension is held to a constant value, and the servo control system regulates the reel motors to maintain a constant tape speed as well.

1-9. REMOTE CONTROL AND OTHER ACCESSORIES

The following accessory units are available for the 58:

1. RC-50 Transport Remote Control Unit
2. RC-51 Full Function Remote Control Unit
3. CS-607 Console Rack (E.I.A. 19" size)
4. RM-500 Rack Mount Angle Kit
5. T-0804 Blank Panel for CS-607
6. RE-1013 TASCAM Metal Reel

Additional accessories are also available. Please refer to the "Optional Equipment and Useful Accessories" section of this manual.

1-10. REFERENCE DATA

The dB; Who, What, Why

No matter what happens to the signal while it is being processed, it will eventually be heard once again by a human ear. So the process of converting a sound to an electrical quantity and back to sound again must follow the logic of human hearing.

The first group of scientists and engineers to deal with the problems of understanding how the ear works were telephone company researchers, and the results of their investigations from the foundation of all the measurement systems we use in audio today. The folks at Bell Laboratories get the credit for finding out how we judge sound power, how quiet a sound an average person can hear, and almost all of the many other details about sound you must know before you can work with it successfully.

From this basic research, Bell Labs developed a system of units that could be applied to all phases of the system. Sound traveling on wires as electrical energy, sound on tape as magnetic energy, sound in air; anyplace that sound is, or has been stored as energy until some future time when it will again be sound, can be described by using the human ear-related system of numbers called "bels" named in honor of Alexander Graham Bell, the inventor of the telephone.

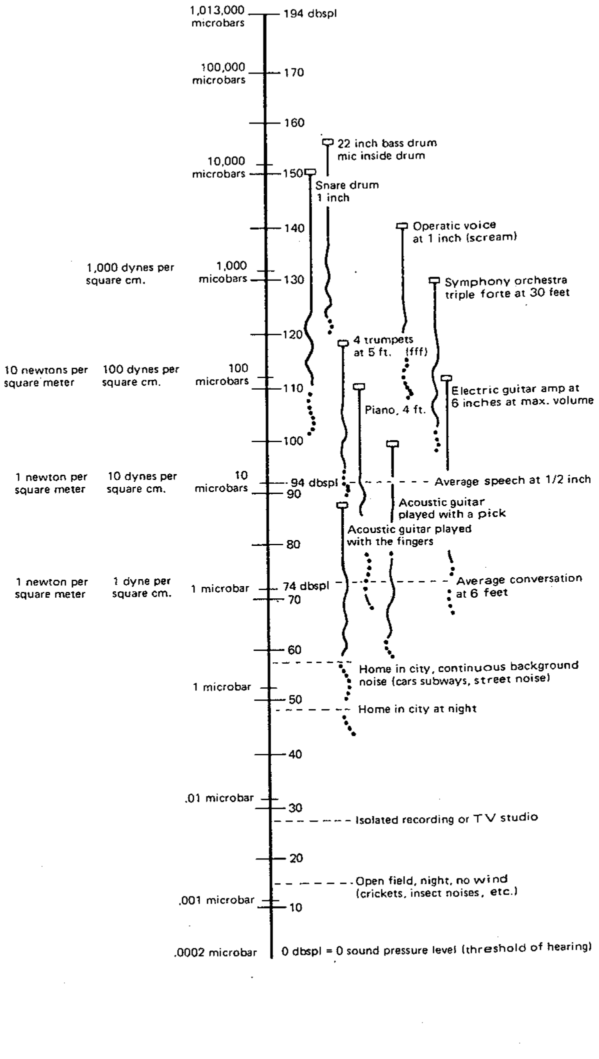
What is a bel and what does it stand for?

It means, very simply, twice as loud to the human ear. Twice as loud as what? An obvious question. The bel is always a comparison between two things. No matter what system of units of measure you are working with at the time, you must always state a value as a reference before you can compare another value to it by using bels, Volts, dynes, Webers — it doesn't matter, a bel, or ear-related statement of "twice as loud" is always a ratio, not an absolute number. Unless a zero, or "no difference" point is placed somewhere, no comparison is possible.

There are many positive and definite statements of reference in use today. But before we go over them, we should divide the "bel" into smaller units. "Twice as loud" will be a little crude to be used all the time. How about one tenth of a bel? Okay, the decibel it is, and 0 means "no difference, same as the reference". It seldom means "nothing". Now, if you double the power, is that twice as loud? No, it is only 3 dB more sound. If you double an electrical voltage, is it twice as loud? No, it is only 6 dB more sound. The unit quantities must follow nonlinear progressions to satisfy the ears' demand.

Remember, decibels follow the ears. All other quantities of measure must be increased in whatever units necessary to satisfy the human requirements, and may not be easy to visualize. Sound in air, our beginning reference, is the least sound the human ear (young men) can detect at 1000 to 4000 Hertz. Bell Labs measured this value to be .0002 microbar, so we say 0 dB = .0002 microbar and work our way up from the bottom, or from the point at which there is "no perceivable sound to humans". Here is a chart of sounds and their ratings in dB, using .0002 microbar pressure change in air as our reference for "0 dB spl" (Sound Pressure Level).

Sound and music reference



Since the reference is assumed to be the lowest possible audible value, dB spl (Sound Pressure Level) is almost always positive, and correctly written should have a + sign in front of the number. But it is frequently omitted. Negative dB spl would indicate so low an energy value as to be of interest to a scientist trying to record one cricket at 1,000 yds. distance, and is of no significance to the multichannel recordist. Far more to the point is the question "What is a microbar?" It is a unit of measurement related to atmospheric pressure and although it is extremely small, it must be divided down quite a lot before it will indicate the minimum pressure change in air that we consider minimum audible sound. This will give you a better idea of the sensitivity of the human ear.

One whole atmosphere, 14.70 pounds per square inch, equals 1.01325 bars. So one whole atmosphere in microbars comes out to be 1,013,250. One microbar of pressure change is slightly less than one millionth of an atmosphere, and you can find it on our chart as 74 dB spl. It is not terribly loud, but it is certainly not hard to hear. As a matter of fact, it represents the average power of conversational speech at 6 feet. This level is also used by the phone company to define normal earpiece volume on a standard telephone. Now think about that minimum audible threshold again:

.0002 microbar.

That's two ten-thousandths of a millionth part of one atmosphere!

This breakdown of one reference is not given just to amaze you, or even to provide a feel for the quantity of power that moderate levels of sound represent. Rather, it is intended to explain the reason we are saddled with a ratio/logarithm measurement system for audio. Adding and subtracting multi-digit numbers might be easy in this age of pocket calculators, but in the 1920's when the phone company began its research into sound and the human ear, a more easily-handled system of numbers became an absolute necessity. Convenience for the scientist and practical engineer, however, has left us with a system that requires a great deal of complex explanation before you can read and correctly interpret a "spec sheet" for almost any piece of gear.

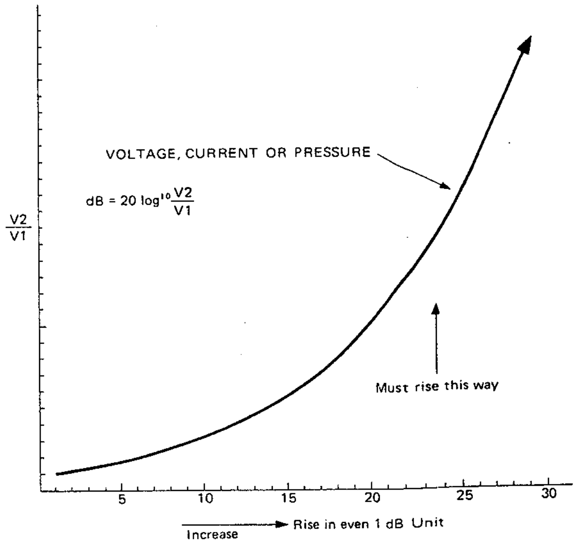
Here are the formulae for unit increment; but they are necessary only for designers, and unless you build your own gear, you won't have to deal with them. For power (watts) increase or loss, calculate by the following equation:

$$10 \text{ LOG}_{10} \frac{P2}{P1} = N \text{ (dB)}$$

For voltage, current or pressure calculations:

$$20 \text{ LOG}_{10} \frac{V2}{V1} = N \text{ (dB)}$$

Plotting the points resultant from using these equations we come up with the following chart. Once we have this chart, we can see the difference between the way humans perceive sound and the amount of force it takes to change air pressure. Unfortunately, the result is not a simple "twice as much pressure" of sound to be heard as "twice as loud". If you plot decibels as the even divisions on a graph, the unit increase you need is a very funny curve.



This is how the ear works, and we must adapt our system to it. We have no choice if we expect our loudspeaker to produce a sound that resembles the original sound we begin with. The high sensitivity to sound of the human ear produces a strong "energy" illusion that has confused listeners since early times. How powerful are the loudest sounds of music in real power? Can sound be used as a source of energy to do useful work, such as operating a car? For any normally "loud" sound the answer is, regrettably, no! perhaps not so regrettably, consider what would happen if one pound of pressure was applied not to your head, but directly to your inner ear. One pound of air pressure variation is 170 dB spl! This amount of "power" might do some useful work – but not much, it's still only one pound and to make use of it you will have to stand one mile away or you will go deaf immediately.

If we reduce our sound power to realistic musical values, we will not be injured, but we will have almost nothing (in real power terms) to run the mic with!

This low available energy is the reason that high gain amplifiers are required for microphones.

When we take a microphone and "pick up" the sound, we do have some leeway in deciding how much energy we must have in order to operate the electrical part of our system. If we can decide that we don't have to truly hear the signal while we are processing it from point to point and we can wait until the electronic devices have done all their routing and switching before we need audible sound, we can lower the power of the signal. What is a good value for a reference here? Well, we need to have enough energy so that the signal is not obscured by hiss, hum, buzz or other unpleasant things we don't want, but not so high that it costs a fortune in "juice" or electrical power. This was a big consideration for the telephone company.

They now have the world's biggest audio mixing system, and even when they started out, electricity was not free. They set their electrical power signal reference as low as was practical at the time, and it has lowered over the years as electronic equipment has gotten better. In 1939 the telephone company, radio broadcasting, and recording industry got together and standardized 1 milliwatt of power as 0 dBm, and this is still the standard of related industries. Thus, a 0 dBm signal into a 600 ohm-line impedance will present a voltage of 0.775 volts.

Once again, we owe you an explanation. Why does it say ZERO on the meter? What is an ohm? Why 600 of them and not some other value? What's a volt? Let's look at one thing at a time.

1. The logic of ZERO on the meter is another hangover from the telephone company practice. When you start a phone call in California, the significant information to a telephone company technician in Boston is – did the signal level drop? If so, how much? When the meter says ZERO it indicates (to the phone company) that there has been no loss in the transmission, and all is well. The reference level is one milliwatt of power, but the gain or loss is in the information the meter was supposed to display, so the logic of ZERO made good sense, and that's what they put on the dial. We still use it even though it's not logical for anything else, and the idea of a reference level described as a "no loss" ZERO, no matter what actual power is being measured, is so firmly set in the minds of everyone in the audio world that it is probably never going to change.

2. One ohm is a unit of resistance to the passage of electrical energy. The exact reasons for the choice of 600 ohms as a standard are connected to the demands of the circuits used for long distance transmission and are not simple or easy to explain. Suffice it to say that the worst possible thing you can do to a piece of electronic equipment is to lower the resistance it is expected to work into (the load). The lower the number of ohms, the harder it is to design a stable circuit. When you think about "load", the truth is just the opposite of what you might expect! 0 ohms is a "short circuit", not resistance to the passage of signal. If this condition occurs before your signal gets from California to Boston, you won't be able to talk – the circuit didn't "get there", it "shorted out". Once again, telephone company logic has entered the language on a permanent basis. Unless the value for ohms is infinity (no contact, no possible energy flow) you will be better off the higher the value, and many working electronic devices have input numbers in the millions or billions of ohms.

3. A volt is a unit of electrical pressure, and by itself is not enough to describe the electrical power available. To give you an analogy that may help, you can think of water in a hose. The pressure is not the amount of water, and fast flow will depend upon the size of the hose (impedance or resistance) as well.

Increase the size of the pipe (lower the resistance, or Z) and pressure (volts) will drop unless you make more water (current) available to keep up the demand. This analogy works fairly well for DC current and voltage, but alternating current asks you to imagine the water running in and out of the nozzle at whatever frequency your "circuit" is working at, and is harder to use as a mental aid. Water has never been known to flow out of a pipe at 10,000 cycles per second.

This reference level for a starting point has been used by radio, television, and many other groups in audio because the telephone company was the largest buyer for audio equipment. Most of the companies that built the gear started out working for the phone company and new audio industries, as they came along, found it economical to use as many off-the-shelf components as they could, even though they were not routing signals from one end of the world to the other.

Must we use this telephone standard for recording? Its use in audio has been so widespread that many people have assumed that it was the only choice for quality audio. Not so.

A 600-ohm, 3-wire transformer-isolated circuit is a necessity for the telephone company, but the primary reason it is used has nothing to do with audio quality. It is noise, hum and buzz rejection in really long line operation (hundreds and hundreds of miles).

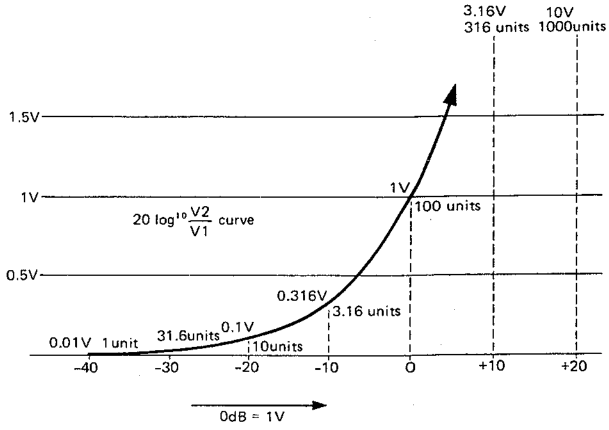
Quality audio does not demand 600-ohm, 3-wire circuitry. In fact, when shielding and isolation are not the major consideration, there are big advantages in using the 2-wire system that go well beyond cost reduction. It is, as a system, inherently capable of much better performance than 3-wire transformer-isolated circuits.

Since TASCAM's mixers are designed to route a signal from a mic to a recorder, we think that the 2-wire system is a wise choice. The internationally accepted standard (IEC) for electronics of this kind uses a voltage reference without specifying the exact load it is expected to drive. The reference is this:

0 dB = 1 Volt

This is now the preferred reference for all electronic work except for the telephone company and some parts of the radio and television business. Long distance electronic transmission still requires the 600-ohm standard. If your test gear has a provision for inserting a 600-ohm load, be sure the load is not used when working on TASCAM equipment.

Now that we have given a reference for our "0 dB" point, we can print the funny curve again, with numbers on it, and you can read voltages to go along with the changes in dB.



Simplify the dB and Its Many Variations

When it comes to describing the level of audio signal in a circuit, the whole issue of "dB's" may seem very complicated to anyone but a mathematically skilled engineer. However, by comparing audio signals to water flowing through a pipe (a "circuit"), we can simplify the concept of dB and audio level so that it is less "magic" and more understandable (we hope).

First, let's define our terms for this comparison:

VOLTAGE: It is similar to WATER PRESSURE. If voltage were truly water pressure, we would express it in pounds per square inch. Actually, another term for voltage is "EMF," which stands for "electro motive force," which really is the pressure on the electrons which causes them to flow through a circuit.

IMPEDANCE: It is similar to the RESISTANCE OF THE WATER PIPE TO THE FLOW OF WATER. Electrically, impedance "impedes" or works against the flow of electrons in an AC circuit, so the restriction to water flow caused by the pipe's diameter and internal surface friction is like impedance. Electrical "resistance," while similar to impedance, applies to DC current. A speaker, for example, may have a 3 ohm DC resistance, but an 8 ohm impedance at 1 kHz.

POWER: It is similar to the AMOUNT OF WATER THAT FLOWS THROUGH THE PIPE. If we were actually measuring water level, we might use a unit of volume such as liters, milliliters, gallons, quarts, ounces, etc. With electrical circuits, we use a unit of power – the watt, 1/1000 watt (the milliwatt).

We can consider the pipe to be the electrical input or output circuit. The pipe's diameter determines its resistance to water flow; a smaller diameter pipe (wire) has a higher resistance (analogous to impedance) because it makes it more difficult for the water (electrons) to flow.

If we aim the pipe up in the air and measure the height of water column that emerges from the end of the pipe, we have a level (power). With a pipe of a given diameter (impedance), the amount of water flowing is proportional to the water pressure (voltage). If you increase the pressure, you increase the height of the water stream emerging from the pipe.

Look at Figure 1 on page 1-12. Note that a 0.775 volt "pump pressure" pushing water through a 600 ohm "pipe" causes the water "level" to reach 1 milliwatt in height. We'll call that level of water (1 milliwatt of power) a level of 0 dBm.

AN ESSENTIAL POINT TO REMEMBER: 0 dBm IS ALWAYS EQUAL TO ONE MILLIWATT. It doesn't matter how much water pressure (voltage) it took to achieve that level, or what pipe diameter (impedance) the water had to flow through . . . if the water level reaches 1 milliwatt, the level is 0 dBm. Any other dBm value is merely a relative power level expressed in reference to the 1 mW level.

Look at Figure 2. Here the same 0.775 volt "pump pressure" is pushing water through a pipe of 1200 ohm impedance. Since less water can flow through the smaller pipe, the water level emerging from the pipe is cut in half: 1/2 milliwatt – half the power. Since, with regard to power, half the level is a decrease of 3 dB, the level is now -3 dBm, not 0 dBm. As you can see, WHEN YOU INCREASE THE IMPEDANCE WITHOUT CHANGING THE VOLTAGE, YOU GET LESS POWER (fewer dBm). Conversely, if you decrease the impedance (large pipe), you'll increase the power (more dBm).

FORGET THE NOTION THAT dBm REQUIRES 1600 OHM "PIPE". While dBm results from a combination of impedance and voltage, it refers only the end result . . . the power (water column height).

Refer to Figure 3. Notice that we can obtain a "level" of 0 dBm with a 1200 ohm pipe . . . it simply takes more pump pressure than with a 600 ohm pipe. Since we doubled the impedance relative to Figure 1 (from 600 to 1200 ohms), we also have to increase the voltage to 1.1 volts (multiplying 0.775 V by 1.414, which is the square root of 2). The end result is the same, 1 milliwatt of power (water), which is 0 dBm.

It should now be clear that defining a level in dBm only defines the power. If you want to use dBm to describe a voltage, you'll have to specify a particular impedance or resistance (pipe), which is typically given as 600 ohms, but could be any impedance or resistance. IF YOU HAVE A CIRCUIT WHICH DOES NOT USE MUCH POWER, BUT IS INSTEAD SENSITIVE TO VOLTAGE, EXPRESSING LEVEL IN dBm IS NOT PARTICULARLY USEFUL. For this reason, other "dB" terms have been devised.

A high impedance input will not draw much power from a circuit unless the voltage is increased to a very high level. Why? Remember that the greater the impedance or resistance (the smaller the pipe), the less current can flow. Today, most mixers, power amplifiers, and other signal processors are no longer designed for 600 ohm input impedance. Instead, they have high impedance inputs which are sensitive to the voltage (pressure) of the input signal, not the power (water level).

When you double the level voltage-wise, you increase it 6 dB, whereas if you double the level power-wise, you increase it by 3 dB. The reason for this apparent discrepancy is not all that complex, but it involves some mathematics that we'll omit here to avoid getting too technical. Suffice it to say that the difference has to do with the fact that power is proportional to voltage squared, and "dB" is a logarithmic quantity. To keep the terms and numbers more appropriate to a voltage sensitive circuit, not a power sensitive one, a "dB" term which refers to voltage was developed — "dBV." The "V" in "dBV" denotes "voltage." (The "m" in "dBm" denotes "milliwatt.")

The 0 dBV reference is 1 volt. It was chosen because it's easier to work with than 0.775 volts when manipulating equations. 0 dBV is always associated with 1 volt, regardless of the impedance. It so happens that 0 dBV (voltage) will produce 0 dBm (power) only in a circuit with 1,000 ohms impedance (assuming voltage and current are in phase). Refer to Figure 4.

NOTE: The "purist" engineers among you will recognize the fact that all dB numbers always refer to a power level, but in practical terms, dBV is used to describe voltages, regardless of the actual circuit impedance.

TASCAM input and output levels have traditionally been rated in dBV because the equipment has high impedance circuitry which senses voltage, not power. There's only one slight complication in our practice of using dBV values, and it comes up when you interface a piece of TASCAM equipment to equipment which another manufacturer rated using an assumed 600 ohms impedance. The equipment will usually work properly, but the level calibration may be slightly inaccurate due to the differences between the dBm and dBV "0 dB" references. Let's look at a practical example.

Refer to Figure 5. Suppose the TASCAM output is rated at 0 dBV, and the other equipment's input to which the TASCAM output is connected is rated at 0 dBm. Guess what happens. The 0 dBV output (1 volt), upon encountering a lower impedance (600 ohms rather than 1,000 ohms), causes more power to flow . . . +2.2 dBm instead of 0 dBm. It's not a big difference, and it can usually be adjusted with a level control — assuming the output circuit is capable of driving 600 ohms (which may or may not be the case). However, the level which causes a "0" indication on the TASCAM output meter will drive the input meter to "+2.2" since it is calibrated based on a 0.775 volt "zero" into 600 ohms assumed impedance.

Refer to Figure 6. To avoid the possible error of 2.2 dB, the term "dBv" was introduced. Like "dBV", "dBv" is used to describe voltage, not power, but 0.775 volts is the "0 dBv" reference. The only difficulty with "dBv" was that many people ignore capitalization and confuse dB "big V" with dB "small v," so the 2.2 dB error persists. For this reason, we are now changing to "dBu" instead of "dBv." They're the same term (0 dBu = 0.775 volts), but hopefully people won't confuse a "u" with a "V".

If a TASCAM output is rated at 0 dBu, it means it puts out 0.775 volts into a high impedance (it may also do so into a low impedance, if so specified). Connect a 0 dBu output to a 0 dBm nominal input, and the meters should match one another.

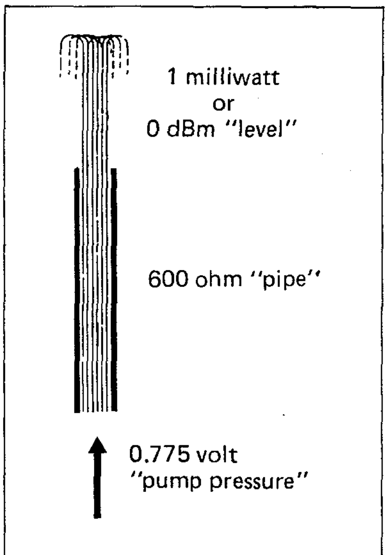

1 milliwatt
or
0 dBm "level"
600 ohm "pipe"
0.775 volt
"pump pressure"

Figure 1.

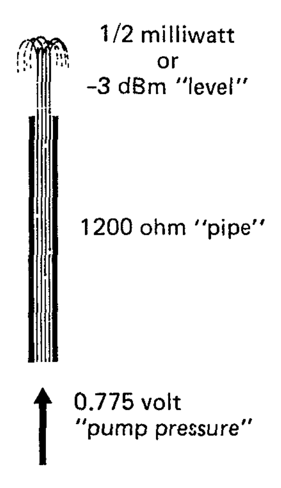

1/2 milliwatt
or
-3 dBm "level"
1200 ohm "pipe"
0.775 volt
"pump pressure"

Figure 2.

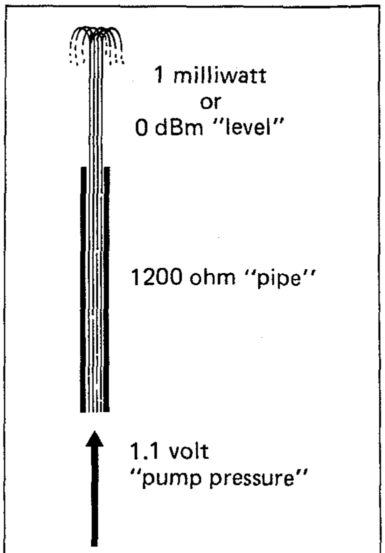

1 milliwatt
or
0 dBm "level"
1200 ohm "pipe"
1.1 volt
"pump pressure"

Figure 3.

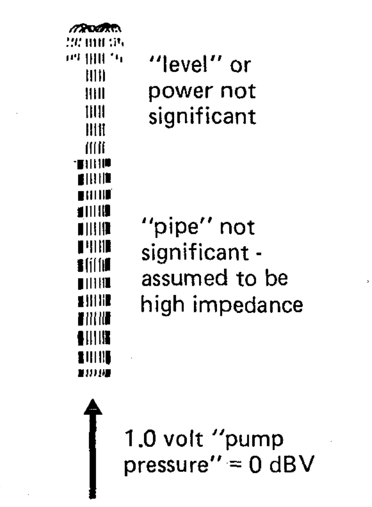

"level" or
power not
significant
"pipe" not
significant -
assumed to be
high impedance
1.0 volt "pump
pressure" = 0 dBV

Figure 4.

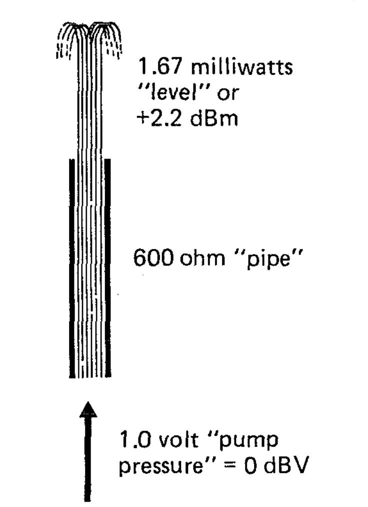

1.67 milliwatts
"level" or
+2.2 dBm
600 ohm "pipe"
1.0 volt "pump
pressure" = 0 dBV

Figure 5.

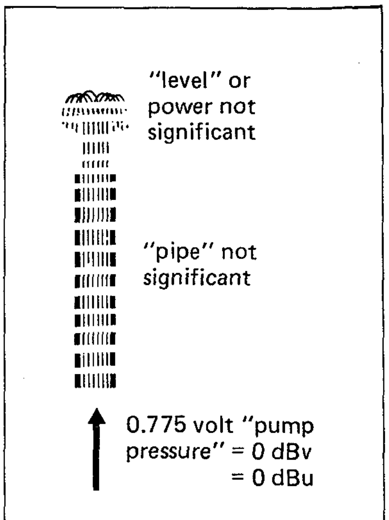

"level" or
power not
significant
"pipe" not
significant
0.775 volt "pump
pressure" = 0 dBv
= 0 dBu

Figure 6.

0 dBV = 1 V	Voltage	0 dBm = 0.775 V/ 600 ohms
+6 dB	2 V	+8.2 dB
+1.78 dB	1.228 V	+4 dB[*2]
0 dB	**1 V**	+2.2 dB
-2.2 dB	**0.775 V**	**0 dB**
-6 dB	0.5 V	-3.8 dB
-8.2 dB	0.388 V	-6 dB
[*1] **-10 dB**	**0.316 V**	-7.8 dB
-12 dB	0.250 V	-9.8 dB
-12.2 dB	**0.245 V**	**-10 dB**
-20 dB	0.1 V	-17.8 dB

Note:
*1. TASCAM STANDARD LEVEL = 0 VU.
*2. Low Impedance System Level = 0 VU.

Impedance Matching and Line Levels

All electronic parts, including cables and non-powered devices (mics, passive mixers and such), have impedance, measurable in ohms (symbol Ω or Z). Impedance is the total opposition a part presents to the flow of signal, and it's important to understand some things about this value when you are making connections in your mixing system. The outputs of circuits have an impedance rating and so do inputs. What's good? What values are best? It depends on the direction of signal flow, and in theory, it looks like this:

OUTPUTS $\xrightarrow{\text{Plug into}}$ **INPUTS**

It is generally said that the output impedance (Z) should be as low as possible. 100 ohms, 10 ohms. The lower, the better, in theory. A circuit with a low output impedance will offer a low resistance to the passage of signal, and thus will be able to supply many multiple connections without a loss in performance or a voltage drop in any part of the total signal pathway. Low impedance values can be achieved economically by using transistors and integrated circuits, but other considerations are still a problem in practice.

1. The practical power supply is not infinitely large. At some point, even if the circuit is capable of supplying more energy you will run out of "juice".
2. Long before this happens, you may burn out other parts of the circuit. The output impedance may be close to the theoretically ideal "ohms" but many parts in the practical circuit are not. Passing energy through a resistance generates heat and too much current will literally burn parts right off the circuit board if steps are not taken to prevent catastrophic failure.
3. Even if the circuit does not destroy itself, too high a demand for current may seriously affect the quality of the audio. Distortion will rise, frequency response will suffer, and you will get poor results.

Inputs should have very high impedance numbers, as high as possible (100,000 ohms, 1 million ohms, more, if it can be arranged). A high resistance to the flow of signal at first sounds bad, but you are not going to build the gear. If the designer tells you his input will work properly and has no need for a large amount of signal, you can assume that he means what he says. For you, a high input impedance is a virtue. It means that the circuit will do its job with a minimum of electrical energy at a beginning. The most "economical" electronic devices in use today have input impedances of many millions of ohms. Test gear, for example, voltmeters of good quality must not draw signal away from what they are measuring, or they will disturb the proper operation of the circuit. A design engineer needs to see what is going on in his design without destroying it, so he must have an "efficient" device to measure with.

SOURCE (output) $\xrightarrow{\text{Plugs into}}$ **LOAD (input)**

The classic procedure for measuring output impedance is to reduce the load's impedance until the output voltage drops 6 dB (half the original power) and note what the load value is. In theory, you now have a load impedance that is equal to the output impedance. If you gradually reduce the load (increase the input impedance), the dB reading will return slowly to its original value. How much drop is acceptable? What load will be left when an acceptable drop is read on the meter?

Traditionally, when the load value (input Z) is approximately seven times the output impedance, the needle is still a little more than 1 dB lower than the original reading.

Most technicians say, "1 dB, not bad, that's acceptable." We at TASCAM must say that we do not agree. We think that a seven-to-one ratio of input (7) to output (1) is not a high enough ratio, and here's why:

1. The measurement is usually made at a mid-range frequency and does not show true loss at the frequency extremes. What about the drop at 20 Hz or 30 kHz?
2. All outputs are not measured at the same time. Most people don't have twenty meters, we do. Remember, everybody plays together when you record and the circuit demands, in practice, are simultaneous. All draw power at the same time.

Because of the widely misunderstood rule of thumb – the seven-to-one ratio – we will give you the values for outputs impedance.

True output impedance
Even though the true output impedance may be low, say 100 ohms, it takes a lab to check the rule of thumb, so for the practical reasons we have explained, the use of the ratio method of impedance calculation must be changed to a higher ratio. We prefer 100:1 if possible and we consider 50:1 to be the minimum ratio that we think safe. Because of this, we will give you a number for ohms that you can match, Minimum Load Impedance. No calculations, we have made them already.

Minimum load impedance
MAKE CERTAIN THAT YOU CONNECT NO TOTAL LOAD IMPEDANCE LOWER (numerically) THAN THIS FIGURE.

LINE OUTPUT: 10k ohms

Nominal load impedance
Our specifications usually show 10,000 ohms as a Nominal Load Impedance. This load will assure optimum performance. Remember, any impedance lower than 10,000 ohms is more load.

Input impedance
Input impedance is more straight forward and requires only one number. Here is the value for the 58.

LINE INPUT: 50k ohms

If one output is to be "Y" connected to two inputs the total impedance of the two inputs must not be lower than the minimum load impedance, mentioned above, and if it becomes necessary to increase the number of inputs with slight reduction of the load specifications, you must check for a drop in level, a loss of headroom, low frequency response, or else suffer from a bad recording. If one input is 10,000 ohms, another of the same 10,000 ohms will give you a total input impedance (load) of 5,000 ohms. To avoid calculations you can do the following when you have two inputs to connect to one output.

Take the lower value of the two input impedance and divide it in half. If the number you have is greater than the minimum load impedance, you can connect both at the same time. Remember, we are not using the true output impedance we are using the adjusted number, the minimum, output load impedance.

If you must have exact values here is the formula for dissimilar 2 loads or inputs:

$$Rx = \frac{R1 \times R2}{R1 + R2}$$

When you have more than two loads (inputs), just dividing the lowest impedance by the number of inputs will not be accurate unless they are all the same size. But if you still get a safe load then the minimum load impedance by this method, you can connect without worry.

If you must have exact values, here is the formula for more than 2 loads or inputs:

$$Rx = \frac{1}{\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} + \ldots\ldots + \frac{1}{Rn}}$$

Rx = Value of Total Load

Finding impedance values on other brands of equipment

When you are reading an output impedance specification, you will occasionally see this kind of statement

Minimum load impedance = x ohms

or

Maximum load impedance = x ohms

These two statements are trying to say the same thing, and can be very confusing. The minimum load impedance says: please don't make the NUMBER of ohms you connect to this output any lower than x ohms. That's the lowest NUMBER. The second statement changes the logic, but says the exact same thing.

Maximum load impedance refers to the idea of the LOAD instead of the number, and says: please don't make the LOAD any heavier. How do you increase the load? Make the number lower for ohms. Maximum load means minimum ohms, so read carefully.

When the minimum/maximum statement is made, you can safely assume that the manufacturer has already done his calculations, and the number given in ohms does not have to be multiplied. You can MATCH the value of your input to this number of ohms successfully; but as always, higher ohms will be okay (less load).

Occasionally, a manufacturer will want to show you that 7 times the output Z is not quite the right idea and will give the output impedance and the correct load this way, they will call the output impedance the True Output Impedance and then will give the recommended minimum LOAD impedance. It may be a higher or lower ratio than 7 times and will be whatever the specific circuit in question requires.

Reference Levels

We should talk about one more reference, a practical one.

Anyone who has ever watched a VU meter bounce around while recording knows that "real sound" is not a fixed value of energy. It varies with time and can range from "no reading" to "good grief" in less time than it takes to blink. In order to give you the numbers for gain, headroom and noise in our mixers, we must use a steady signal that will not jump around. We use a tone of 1000 Hz and start it out at a level of -60 dB at the mic input, our beginning reference level. All levels after the mic input will be higher than this, showing that they have been amplified, and eventually we will come to the last output of the mixer — the line-out and the reference signal there will be -10 dB, our "line level" reference.

From this you can see that if your sound is louder than 94 dB spl or — your mic will produce more electricity from a sound of 94 dB spl than -60 dB, all these numbers will be changed. We have set this reference for mic level fairly low. If you examine the sound power or sound pressure level (spl) chart on page 1-6 you will see that most musical instruments are louder on the average than 94 dB spl, and most commercial mics will produce more electricity than the -60 dB for a sound pressure of 94 dB, so you should have no problems getting up of "0 VU" or your recorder.

We should also make a point of mentioning that the maximum number on the chart on page 1-6 represents "peak power" and not average power. The reason? Consider if even some momentary part of your recording is distorted, it will force a re-recording and it is wisest to be prepared for the highest values and pressure even if they only happen "once in a while". On this point, statistics are not going to be useful, the average sound pressure is not the whole story. The words themselves can be used as an example. Say the word "statistics" close to the mic while watching the meters and the peak LED level detector. Then say the word "average". What you are likely to see are two good examples of the problems encountered in the "real world" of recording. The strong peaks in the "s" and "t" sounds will probably cause the LED's to flash long before the VU meter reads anywhere near "zero" while the vowel sounds that make up the word "average" will cause no such drastic action.

To allow peaks to pass undistorted through a chain of audio parts, the individual gain stages must all have a large reserve capability. If the average is X, then X + 20 dB is usually safe for speech, but extremely percussive sounds may require as much as 40 dB of "reserve" to insure good results. Woodblocks, castanets, latin percussion (guido, afuche) are good examples of this short term violence that will show a large difference between "LED flash" and actual meter movement. When you are dealing with this kind of sound, believe the LED, it is telling you the truth.

If you are going to record very loud sounds you may produce more electrical power from the mic than the mixer can handle as an input. How can you estimate this in advance? Well, the spl chart and the mic sensitivity are tied together on a one-to-one basis. If 94 dB spl in gives -60 dB (1 mV) out, 104 dB spl will give you -50 dB out, and so forth. Use the number on our chart for sound power together with your mic sensitivity ratings to find out how much level, then check that against the maximum input levels for the various jacks on your mixer. If your mic is in fact producing -10 dB or line level, there is nothing wrong with plugging it into the line-level connections on the mixer. You will need an adaptor, but after that it will work!

Most mic manufacturers give the output of their mics as a minus-so-many-dB number, but they don't give the loudness of the test sound in dB, it's stated as a pressure reference (usually 10 microbars of pressure). This reference can be found on our sound chart. It is 94 dB spl, 10 microbars, 10 dynes per cm^2 or 1 Newton per square meter. For mics, the reference "0" is 1 volt (dB). So, if the sound is 94 dB spl the electrical output of the mic is given as -60 dB, meaning so many dB less than the reference 0 = 1 volt. In practice you will see levels of -60 dB for low level dynamics, up to about -40 dB or slightly higher for the better grade of condenser mics available today. TASCAM recorders and mixers work at a level of -10 dB referenced to 1 volt (.316 volt) so, for 94 dB spl, a mic with a reference output of -60 dB will need 50 dB of amplification from your mixer or recorder in order to see "0 VU" (-10 dB) on your meter. Now, if the sound you want to record is louder than 94 dB spl, the output from the mic will be more powerful and you will need less amplification from your mixer to make the needles on your recorder read "0 VU".

Levels on Tape

The level of a signal recorded on tape is not measured in dBm, dBV, dBv, dBu, or VU. All those units refer to voltage or power levels, but signals are stored on tape as changing magnetic flux levels. When that stored flux is drawn past a coil of wire (the tape head), a voltage is induced. A Weber is a unit of "moving flux" . . . it describes the amount of magnetism on the tape that will induce 1 volt when the tape passes a specified single-turn coil during one second. A Weber involves such a large amount of magnetism that we use the nanoWeber as a practical unit. It is one thousandth of one millionth of a Weber.

Actually, tape recorded level is expressed in terms of that voltage produced in an idealized tape head at a given rate of change in the magnetic field on the tape, with a given track width (specified as 1 meter, which is about 500 times wider than a typical reel-to-reel track and over a thousand times wider than a cassette track). Thus, the actual voltage level induced in your tape head depends not only on the changing magnetic flux stored on the tape, but also on the tape speed, track width and head design. The tape machine manufacturer will take care of these details by designing his machine based on a standardized level recorded on the tape.

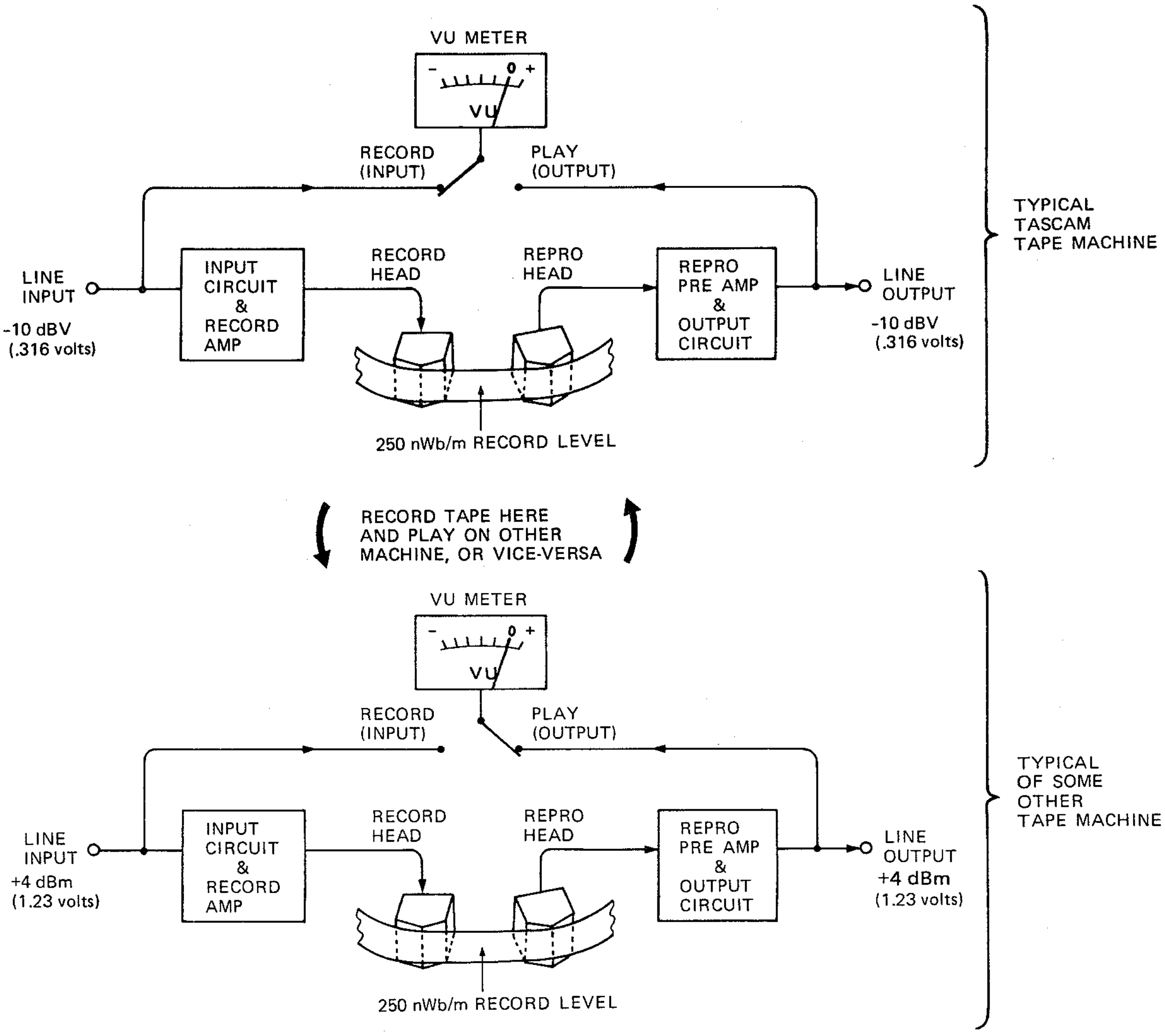

VU METER
VU
RECORD (INPUT)
PLAY (OUTPUT)
LINE INPUT
-10 dBV (.316 volts)
INPUT CIRCUIT & RECORD AMP
RECORD HEAD
REPRO HEAD
REPRO PRE AMP & OUTPUT CIRCUIT
LINE OUTPUT
-10 dBV (.316 volts)
250 nWb/m RECORD LEVEL
TYPICAL TASCAM TAPE MACHINE
RECORD TAPE HERE AND PLAY ON OTHER MACHINE, OR VICE-VERSA
VU METER
VU
RECORD (INPUT)
PLAY (OUTPUT)
LINE INPUT
+4 dBm (1.23 volts)
INPUT CIRCUIT & RECORD AMP
RECORD HEAD
REPRO HEAD
REPRO PRE AMP & OUTPUT CIRCUIT
LINE OUTPUT
+4 dBm (1.23 volts)
250 nWb/m RECORD LEVEL
TYPICAL OF SOME OTHER TAPE MACHINE

Figure 7.

There are three commonly used reference flux levels for open reel tape machines: 185, 250 and 320 nanoWebers per meter. 185 nWb/m used to be the standard record level for most tapes, and remains so on consumer equipment. Then higher output (elevated level) tapes came along at 250 nWb/m. The 320 nWb/m level is a high output tape level used primarily on IEC (European) equipment. TASCAM machines, and most other professional tape machines, use 250 nWb/m as the standard tape reference level.

A standard reference level of 250 nWb/m means this: a "0" reading on the tape machine's record level meter will cause the tape to be magnetized to a flux density that corresponds to 250 nWb/m. It makes no difference what electrical signal level is required to get that "0 VU" reading; the tape will have a standard magnetic level. Consider the significance.

Various manufacturers' open reel tape machines can be calibrated so that a 250 nWb/m nominal flux (or 185 or 320 nWb/m) is recorded with nominal signal levels at the tape machine's RECORD IN jacks. The nominal signal level (corresponding to a "0" reading on the tape machine's meters) might be -10 dBV (316 millivolts), 0 dBm (1 milliwatt), 0 dBu (0.775 volts), 0 dBV (1 volt), +4 dBm (1.23 volts), +8 dBm (1.95 volts), or any level. This means you can take a tape made on a TASCAM machine, with -10 dBV nominal input and output levels, and play that same tape on another model of tape machine with +4 dBm nominal input and output levels. If you had recorded a test tone at "0" level on the TASCAM machine's meters, it will play back at "0" level on the other equipment. (Refer to Figure 7.) The opposite is also true . . . tapes made on other machines with different nominal input and output signal levels can be played back at the correct level on the TASCAM machine . . . so long as both machines use the same standard 250 nWb/m reference level on the tape. The standard reference level for cassette recorders is 160 nWb/m, while Dolby* calibration level for cassettes is 200 nWb/m. Again, any cassette recorded at a "0 VU" or "0 dB" input level with 160 nWb/m reference level on the tape (or Dolby cassette at 200 nWb/m) will play back on any other cassette machine at "0" level, regardless of the actual input and output audio signal levels. In fact, there's only a maximum of 3 dB to 6 dB difference between any of the standard flux levels on any tape, as measured on the tape machine's meters, so compatibility in level should never be a significant factor.

NOTE: If you're using a test tape for level calibration, be sure you're playing it at the specified speed. Playing a 0 dB reference tone on a 7.5 ips test tape at 15 ips will cause the output meter to show +3 dB because twice as much magnetic flux is moving past the head each second. The track format or track width have little bearing here because most test tapes are recorded "full track," with the tone across the entire tape width, so the head will get to "sample" an appropriate amount of flux for its calibration standard.

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*Dolby is the registered trademark of Dolby Laboratories Licensing Corp., San Francisco, CA.

1-11. MORE INFORMATION IS AVAILABLE

We've tried to give you representative examples of some of the things you can do to get started, and you'll discover many more – some by way of happy coincidence, others after long hours of concentration. If you're just getting into recording and want to expand your knowledge, more information is available.

BIBLIOGRAPHY

Beranek, Leo L.
ACOUSTICS
McGraw-Hill Book Co. Inc.
New York, New York
1954
More concerned with exact formulae, but still very readable. It is not necessary to do calculations to gain knowledge from this textbook.

Beranek, Leo L.
MUSIC, ACOUSTICS AND ARCHITECTURE
John Wiley & Sons, Inc.
New York, N.Y.
1962
A technical survey on concert halls with much documentation. Worth reading, this author has many useful stories to tell about the interface of science and art.

Clifford, Martin
MICROPHONES: HOW THEY WORK AND HOW TO USE THEM
Tab Books
Blue Ridge Summit, Pa.
1977
An excellent low cost book for the beginner on microphone types, history and construction. The explanations given assume no prior knowledge and are very complete. Recommended.

Everest F. Alton
ACOUSTIC TECHNIQUES FOR HOME AND STUDIO (3rd. Printing)
Tab Books
Blue Ridge Summit, Pa.
1978
Low cost basic book. This book on studio acoustics is the easiest to read and understand of all the textbooks on the subject, and comes closest to dealing with the actual problems encountered in the home studio.

Everest F. Alton
HANDBOOK OF MULTICHANNEL RECORDING
Tab Books
Blue Ridge Summit, Pa.
1976
A survey volume containing good information on all topics. Very clearly written and recommended for a beginner.

Nisbett, Alec
THE TECHNICS OF THE SOUND STUDIO FOR RADIO, TELEVISION AND FILM
Hastings House Publishers, Inc.
New York, N.Y.
1976
Although not specifically written for the tape recordist, this 500 page book is well worth its cost. Very useful practical advice if you are working with speech (drama, commercial announcing, etc.)

Nisbett, Alec
THE USE OF MICROPHONES
Hastings House
New York, N.Y.
1976
The authors point of view is basically radio, but has ability to communicate difficult concepts is very good. Well illustrated.

Olsen, Harry F.
ACOUSTICAL ENGINEERING
D. Van Nostrand Company
New York, N.Y.
1957

and

Olsen, Harry F.
MUSICAL ENGINEERING
D. Van Nostrand Company
New York, N.Y.
1959
Anything you can find by this writer is worthwhile, and the latter book in particular will give scientific answers to questions (what frequency is the note D♭ above middle C?) and can be used to translate one "language" into another. Extremely valuable.

Rettinger, Michael
ACOUSTIC DESIGN AND NOISE CONTROL, VOL. 1
Chemical Publishing Company
New York, N.Y.
1977
Although this book is highly technical, the writing is very lucid and many examples are given to go along with the math. This writer is not afraid to draw conclusions and give his reasons for doing so in simple language.

Runstein, Robert E.
MODERN RECORDING TECHNIQUES
Howard W. Sams and Co.
Indianapolis, Indiana
1974
The first low cost book on studio practice. The equipment dealt with is somewhat outdated, but the theory is still the same. Excellent basic survey.

Tremaine, Howard M.
THE AUDIO CYCLOPEDIA
Howard W. Sams and Co.
Indianapolis, Indiana
1976
This 1,700 page reference work is sure to contain the answer to almost any technical question you can think of. The writing assumes much prior knowledge and this book should be used with others that are more basic in their writing style if you are new to the field of scientific audio.

SOME MAGAZINES OF INTEREST:

"db" – THE SOUND ENGINEERING MAGAZINE
1120 Old Country Road
Plainview, N.Y. 11803

"MODERN RECORDING"
14 Vanderventer Avenue
Port Washington, N.Y. 11050

"RE/P" – RECORDING ENGINEER/PRODUCER
1850 Whitley Street, Suite 220
Hollywood, Ca. 90028

2. SPECIFICATIONS

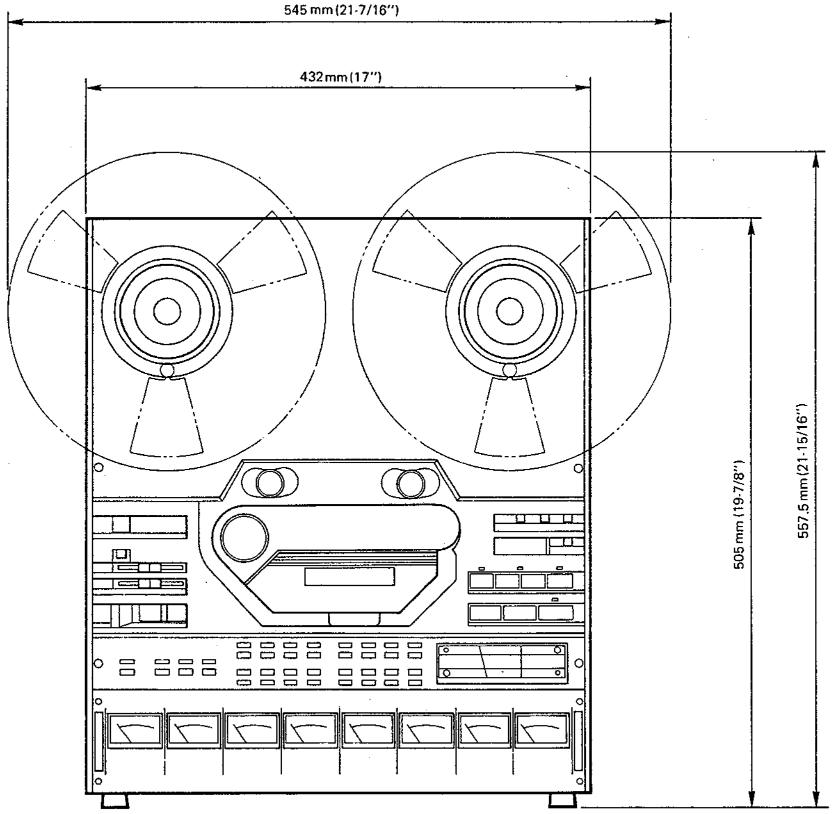
MECHANICAL

Tape:	1/2 inch, 1.5 mil, low noise, high output tape
Track Format:	8-track, 8-channel, track width 0.039 inch (1.0 mm)
Reel Size:	10-1/2" NAB (large) Hub
Tape Speed:	15 inches per second (38 cm/sec.)
Speed Accuracy:1)	±0.5 % deviation
Pitch Control:	
Coarse:	±15 %
Fine:	±0.7 %
Wow and Flutter:1)	±0.08 % peak (DIN/IEC/ANSI, weighted) ±0.12 % peak (DIN/IEC/ANSI, unweighted) 0.04 % RMS (JIS/NAB, weighted) 0.07 % RMS (JIS/NAB, unweighted)
Fast Wind Time:	120 seconds for 10-1/2" reel, 2400 feet
Spooling Wind Time:	370 seconds for 10-1/2" reel, 2400 feet
Start Time:	Less than 0.8 sec. to reach standard Wow and Flutter
Tape Drive System:	
Capstan motor:	FG (frequency generator), DC, direct drive motor
Reel motors:	Slotless DC motor x 2
Head Configuration:	3 heads; erase, record and reproduce x 2
Tape Cue:	Manual and automatic (RTZ and STC)
Motion Sensing:	0.5 sec. ±0.15 sec. delay time stop to next motion; tension servo system
Mounting:	Standard 19-inch rack with optional RM-500
Remote Control:	Full/Basic functions available with optional RC-51/RC-50
Dimensions:	432(W) x 505(H) x 316(D) mm (17 x 19-7/8 x 12-7/16 inch)
Weight:	35 kg (77-3/16 lbs.)

ELECTRICAL

Line Input:	
Input impedance:	50k ohms, unbalanced
Maximum Source Impedance:	2.5k ohms
Nominal input level:	-10 dBV (0.3 V)
Max. input level:	+19 dBV (8.9 V)
Line Output:	
Output impedance:	500 ohms, unbalanced
Min. load impedance:	10k ohms, unbalanced
Nominal load impedance:	50k ohms, unbalanced
Nominal output level:	-10 dBV (0.3 V)
Max. output level:	+19 dBV (8.9 V)
Bias Frequency:	150 kHz
Equalization:	∞ μsec + 35 μsec IEC standard (International Electrotechnical Commission), CCIR (International Radio Consultative Committee)
Record Level Calibration:	0 VU reference; 250 nWb/m tape flux level
Frequency Response:	
Record/Reproduce: 3)	40 Hz – 20 kHz, ±3 dB at 0 VU 40 Hz – 20 kHz, ±3 dB at -10 VU
Sync and Reproduce: 2)	40 Hz – 20 kHz, ±3 dB
Total Harmonic Distortion:3)	0.8 % at 0 VU, 1000 Hz, 250 nWb/m 3 % at 12 dB above 0 VU, 1000 Hz, 1000 nWb/m
Signal-to-Noise Ratio:3)	At a reference of 1 kHz, at 12 dB above 0 VU, 1000 nWb/m 69 dB A weighted (NAB), 62 dB unweighted 107 dB A weighted (NAB), with dbx* 100 dB unweighted, with dbx
Adjacent Channel Crosstalk (Overall):3)	Better than 50 dB down at 1000 Hz, 0 VU

Erasure:[3]	Better than 70 dB at 1000 Hz, +10 VU reference
Headroom:	
Recording Amplifier:	Better than 26 dB above 0 VU at 1 kHz
Reproduce Amplifier:	Better than 44 dB above 0 VU at 1 kHz
Connectors:	
Line inputs and outputs:	R.C.A. jacks
Remote control unit:	Multi-pin type connector
Accessory (ext. sync):	Multi-pin type connector
dbx unit (control signal):	Multi-pin type connector
Power Requirement:	100/120/220/240 V AC, 50/60 Hz, (General Export Model) 180 W 120 V AC, 60 Hz, (USA/ Canada Model) 180 W 220 V AC, 50 Hz, (Europe Model) 180 W 240 V AC, 50 Hz, (UK/AUS Model) 180 W

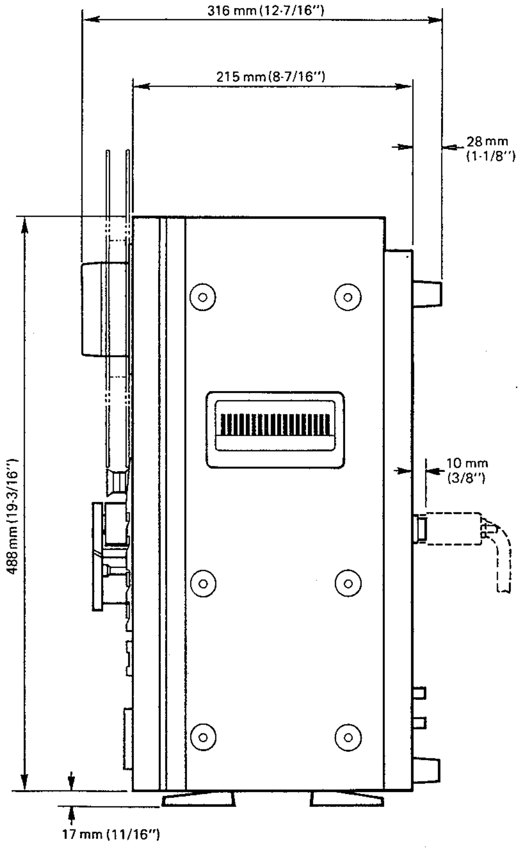


In these specifications, 0 dBV is referenced to 1.0 Volt. Actual voltage levels also are given in parenthesis. To calculate the 0 dB = 0.775 Volt reference level (i.e., 0 dBm in a 600-ohm circuit) add 2.2 dB to the listed dB value; i.e., -10 dB re: 1 V = -7.8 dB re: 0.775 V.

1) Specifications were determined using STL Test Tape 62 or equivalent.
2) Specifications were determined using TEAC Test Tape YTT-1144SP.
3) Specifications were determined using TEAC Test Tape YTT-8163.

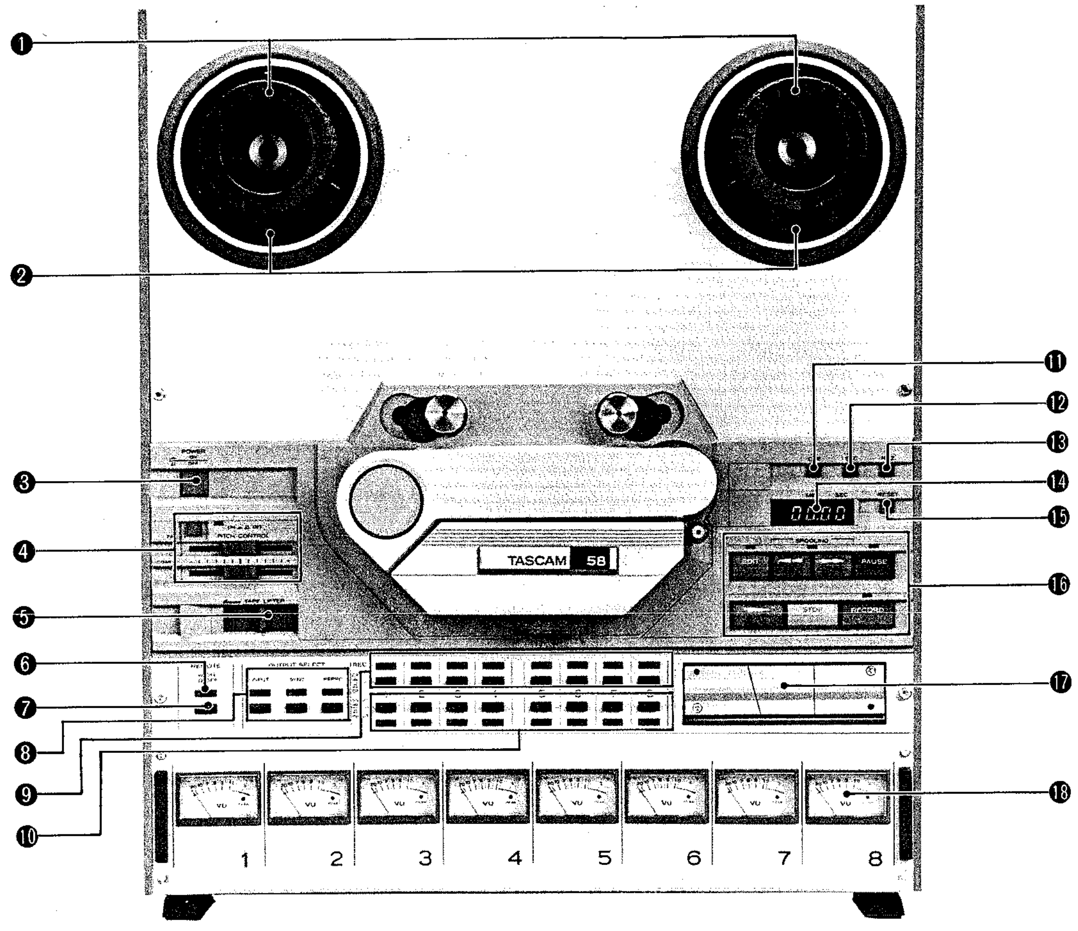
Changes in specifications and features may be made without notice or obligation.
*dbx is a trademarks of dbx Inc.

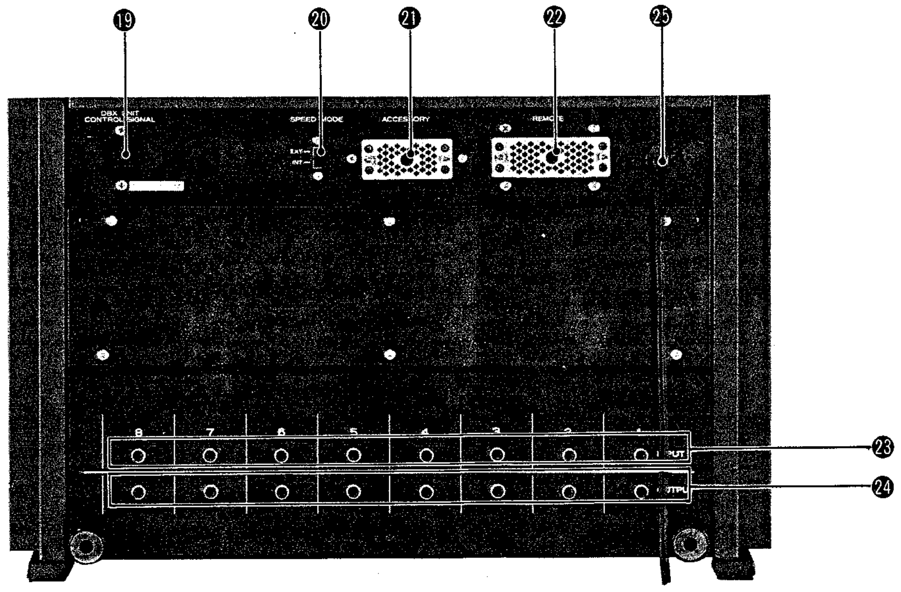
Options for:	
Mounting (EIA standard 19 inch rack):	RM-500 Rack Mount Angle Kit, CS-607 Console Rack and T-0804 Blank Panel.
Remote control:	Full function transfer with RC-51, Transport control transfer with RC-50.
Tape mounting:	RE-1013 TASCAM Metal Reel.



Note:
Since the connectors, because of their size, protrude well beyond the feet of the deck, be sure they are not damaged in any way when laying the 58 on its back, and by all means, don't forget to allow ample space between the 58 and the wall when planning layout and set-up in your studio. For exact dimensions, refer to the illustration on page 3-7 and 4-11.

3. FEATURES AND CONTROLS





❶ NAB Hub Adaptors
These large hub adaptors are permanently mounted, and are for use with reels up to 10-1/2 inches in diameter. Rotate the adaptor ring clockwise to fully tighten the reel.

❷ Reel Tables
Only 1/2" tapes are to be used. We recommend using the same size and type of reel for both the supply and takeup sides so that the servo system maintains proper tape tension.

❸ POWER Switch
This switch turns on the AC power to the unit. As soon as power is turned on: the VU meters are illuminated, the digital counter indicates "00.00" and the PAUSE LED begins flashing at a rate of 1 Hz. After about 3 seconds, the PAUSE LED turns off, indicating the machine's logic circuitry has been initialized (i.e., all the control lines have achieved stand-by status).

❹ PITCH CONTROL Switch and Sliders
When the PITCH CONTROL switch is off, the adjacent LED is also off, indicating the 58 is in fixed pitch mode and will play or record at 15 ips exactly. When the switch is on, the LED turns on, and the COARSE and FINE adjustment sliders may be used to change the tape speed. Sliding the controls to the right (+) increases record/play speed, while sliding them to the left (-) decreases the speed. The range of pitch adjustment is ±0.7 % for the FINE slider, and ±15 % for the COARSE slider. For the most stable operation at exactly 15 ips (38 cm/sec), be sure to turn off the PITCH CONTROL switch. Synchronization from exterior equipment can be performed, irrespective of the PITCH CONTROL on/off settings, when:

1) The SPEED MODE switch on the rear panel is set to EXT.
2) An external control signal is actually being received.
3) A synchronous pulse of 9600 Hz, 2 V or more (nominal) is applied.

If these conditions are met, the LED adjacent to the PITCH CONTROL switch will begin flashing to indicate that synchronization from an external synchronizer/controller is possible. When the LED turns off, it is signifying that the syncronous pulse being received is so "off" the nominal value that exterior synchronization can not be effectuated.

❺ TAPE LIFTER Lever
Sliding this lever slightly to the left, while the machine is in the fast forward or rewind mode, disables the muting circuit (i.e., the line outputs are no longer muted). Sliding the lever further to the left progressively retracts the tape lifters so the tape contacts the heads, allowing monitoring of the tape to find a cue (slate tone) or the end of a program during a high speed wind.
CAUTION: Sliding the TAPE LIFTER lever to monitor tape during a high speed wind will cause high-level, very high frequency audio signals to appear at the 58 outputs. Be sure that you turn down the level of your monitor speaker amplifier prior to operating the TAPE LIFTER lever so that speaker components will not be damaged by excess high frequency energy. It's your responsibility to protect your monitors.

❻ REMOTE LED Indicator
This light emitting diode turns on when the REMOTE switch is turned on. It indicates that remote operation from the RC-51 is possible.

❼ REMOTE Pushbutton
Latch this button in the ON position in order to use RC-51 Full Function Remote Control Unit which interfaces to the REMOTE connector on the 58 rear panel.
The REMOTE on-off switch, when on, activates the RC-51 and permits transfer of the OUTPUT SELECT, REC and pre-load (SYNC/INPUT) functions from the 58 to the RC-51. The switch has no effect on the transport controls: even when off, the transport controls (except EDIT), auto locator (CUE, STC, RTZ), digital counter and RESET functions can always be remote-controlled from the RC-51 as well as the RC-50 Transport Remote Control Unit. In record or record/pause mode, a momentary muting circuit prevents clicks from reaching the 58 line output while the REMOTE switch is operated. If the 58 is in the record/pause, record ready or record mode, it will automatically enter stop mode if the REMOTE on-off switch is operated. This avoids the chance of accidental tape erasure in the event of improper remote unit or transport function switch settings.
NOTE: Be sure to turn the 58 off before connecting the remote control unit. Also be sure to turn this REMOTE pushbutton off when the remote unit is not in use.

❽ OUTPUT SELECT Switches

These 3 switches determine which signal is to be fed to the VU meters and output jacks, as follows:

INPUT: Selects the input to the track (for alignment).

SYNC: Selects the record/sync head signal for synchronous reproduction, or the input signal, depending on the record or reproduce status of the machine, on the setting of the track's REC function switch, and on the setting of the track's pre-load (SYNC/INPUT) switch, as explained in subsequent paragraphs. This setting is the one used most often during production.

REPRO: Selects signal from the repro head. Used during alignment, and can be used for mixdown.

❾ REC Function Switches and LEDs

These 8 switches determine whether a particular track will enter record mode when the RECORD and play (▶) buttons are pressed. If the machine is already in record ready mode, engaging a REC function switch will place the track in record. With the switch up (OFF), no recording is possible on the track, and the track's REC LED is off. With the switch down (ON), the track is able to record and, if the machine is in record ready mode (after pressing RECORD and play (▶)), or if it is in record/pause mode (after pressing RECORD and PAUSE), the LED will stay on. If the machine is in any other mode with the REC function switch down, the LED will flash on and off to indicate the track is ready to record.

Assuming the "SYNC" OUTPUT SELECT switch is engaged, whenever a track's REC function switch is up (OFF), that channel's output will be derived from the record/sync head regardless of the machine's record or play status, permitting safe, synchronous playback during inserts or overdubs. When the REC function switch is down (ON), that channel's output will depend on the associated pre-load (SYNC/INPUT) switch.

❿ Pre-Load (SYNC/INPUT) Switches

When making an insert (punch-in), the performer needs to hear synchronous playback from the track (via the record/sync head) up to the point recording is initiated. Then the performer must hear himself. For this function, any number of tracks can be pre-loaded by setting the pre-load switch(es) to SYNC.

SYNC can also be used for making overdubs, although when making an overdub, the performer usually needs to hear himself continuously playing (or singing or speaking) in sync with previously recorded tracks prior to and during the overdub. Setting the pre-load switch(es) to INPUT accomplishes this goal. For further details, refer to the "Operation" section of this manual.

NOTES:

1. Even when the SYNC switch is depressed, and both the REC function and pre-load (SYNC/INPUT) switches are on (for sync repro/record operation), the INPUT signal always appears at the output terminals when you are not recording and when sync reproduction is not possible. That is, you will hear the input when the transport is in stop mode, fast winding modes, or during STC and RTZ searches.
2. The output is momentarily muted when the SYNC switch is actuated (about 1/2 second) to prevent switching noise.
3. When the REC function switch is turned on, an LED begins flashing to indicate that the unit is in the record ready mode. Steady illumination of this LED means the unit is recording.
4. When the pre-load (SYNC/INPUT) switch is set to SYNC (switch down), an LED lights if the RECORD button is off; the LED turns off when record mode is engaged. The pre-load switches have no effect if the REC function switch is off.

⓫ CUE Pushbutton

Press this button to set a cue point. The cue is not actually placed on the tape; instead, the 58 "remembers" the precise position of the tape counter at the moment the CUE button was pressed, and will return to that point whenever the STC button is subsequently pressed (Search-To-Cue). Until a "cue" is entered, the machine will assume a "00.00" cue point. Whatever cue point had been memorized remains valid until a new cue is established by again pressing the CUE button.

⑫ STC Pushbutton

Pressing the STC button activates the search-to-cue function, which winds tape rapidly forward (or rewinds) and stops at the established cue point (which must previously have been entered using the CUE button). The search-to-cue operation may be commanded from any tape motion status (i.e., from stop mode, or during play, rewind, etc.).

⑬ RTZ Pushbutton

Pressing the RTZ button activates the return-to-zero function, which causes the transport to fast wind to "00.00" on the tape counter. The RTZ button, like the STC button, can be activated from any tape motion status.

⑭ Digital Counter Display

The counter displays the elapsed time of the tape, as wound from the initial "00.00" point. The counter measures linear tape footage, then computes elapsed time based on a 15 ips (38 cm/sec) play/record speed. Thus, even if the tape is actually wound to a cue point at high speed, the counter will indicate the correct running time. The maximum time displayed is 99 minutes, 59 seconds in either direction. When counting in reverse direction (prior to the "00.00" point), a minus (-) sign is displayed at the left of the counter. The counter will indicate "00.00" when power is first turned on, or when the RESET button is pressed.

⑮ RESET Pushbutton

Pressing the RESET button resets the tape counter to "00.00". Because RESET does not clear the information stored as the cue point, the memorized cue time remains as set, even when the counter displays "00.00". However, the cue is memorized as a time relative to "00.00", so the actual cue point (the location on the tape at which the machine will stop) will change if the counter is reset to a different zero point.

⑯ Transport Controls

EDIT Pushbutton

The EDIT button has no effect unless pressed when the machine is in stop mode or pause mode. Then the EDIT LED turns on to indicate the unit is in edit mode.

If EDIT is pressed when tape is stopped, the reel motor brakes are disengaged and a small, proportional amount of back tension is held by each reel motor so that the reels may be moved easily by hand for editing purposes, yet slack will be eliminated.

If EDIT and play (▶) are pressed simultaneously, the transport enters dump edit mode. The capstan and pinch roller pull tape past the heads at the set 15 ips (38 cm/sec) or at the adjusted pitch, allowing the operator to listen to playback for a particular edit point. However, the takeup reel does not turn, allowing tape to spill off the machine until the edit point is reached (the takeup tension arm position is "ignored" by the shut-off sensing logic). Upon reaching the desired point, pressing the STOP button stops tape and cancels edit mode.

NOTE: If the EDIT button has been pressed (LED on) to place the machine in edit mode, and the play (▶) button is pressed subsequently, the machine will not enter dump edit mode (the two buttons must be pressed simultaneously). Instead, edit mode will be cancelled, and tape will begin moving normally as the machine enters reproduce (play) mode.

EDIT LED (Yellow)

This LED is on when the machine is in edit mode.

Rewind Pushbutton (◀◀)

Pressing this button selects the rewind mode, which may be entered from any other mode. Pressing it a second time after the machine is placed in rewind mode causes the tape to slow to an intermediate winding speed, the reverse spooling mode. Spooling is used for a rapid yet extremely uniform, tight tape pack. The third pressing of this button returns the machine to rewind mode. The approximate tape speeds are: for rewind, 240 ips (610 cm/sec), and for spooling, 80 ips (203 cm/sec).

Fast-Forward Pushbutton (▶▶)

Pressing this button selects the fast-forward mode. The button functions similarly to the rewind button in that pressing it a second time causes the machine to enter forward spooling mode.

SPOOLING LED (Green)

When either the ◀◀ or ▶▶ button is pressed twice to place the machine in reverse or forward spooling mode, this LED turns on.

PAUSE Pushbutton
Pause mode may be entered from stop, edit, play or record modes. Pressing the PAUSE button stops tape (if it is running in play mode). It also "cocks" the pinch roller to an intermediate position so that play mode can be entered most rapidly. Pressing the PAUSE button places the unit in pause mode and turns on the PAUSE LED.

If the PAUSE and RECORD buttons are pressed simultaneously, the unit is in record pause mode; the PAUSE and RECORD LEDs will both be on, and the record electronics will be engaged (that is, the bias will be turned on) allowing for spot erasure by manual turning of the reels. To enter normal record mode from record/pause, it is necessary to press both the RECORD and play (▶) buttons.

There is one other time when the PAUSE LED is on – it flashes for about three seconds when the AC power is first turned on, indicating the machine is not yet ready to operate while the logic is being initialized.

Play Pushbutton (▶)
Pressing the play (▶) button places the machine in play mode. When play (▶) is pressed during fast-forward, rewind or spooling mode, the machine will enter play mode after tape has stopped. If play (▶) is pressed during a search operation (using STC or RTZ), the machine will enter play after the cue or "00.00" point has been reached.

To enter record mode, simultaneously press the play (▶) and RECORD buttons. To punch out of record mode, while keeping tape rolling at play speed, again press the play (▶) and RECORD buttons. Subsequently pressing play (▶) and RECORD together will toggle the machine between play and record modes for additional punch ins and punch outs.

RECORD Pushbutton
Pressing this button simultaneously with the play (▶) button initiates record mode. Recording actually occurs only on those tracks whose REC function pushbuttons are down (ON); on those channels, the LEDs will cease flashing and will stay on, indicating recording is in progress. Pressing the same two buttons, RECORD and play (▶), a second time cancels record mode but allows tape to continue playing.

RECORD LED Indicator
This red LED turns on in the RECORD/play (▶) or RECORD/PAUSE mode. The RECORD LED will remain on continuously if one or more REC function switches are on, indicating that recording is taking place; if none of the REC function switches are on, the LED will flash at a rate of 1 Hz, indicating the unit is ready to begin recording.

STOP Pushbutton
Pressing this button stops tape motion, and cancels any other mode of operation.

⑰ Splicing Block
This precision aluminum splicing block has been provided to facilitate editing. Neat, uniform splices can be made by laying the magnetic tape in the slot, and using the block's pre-cut grooves to guide your razor blade.

⑱ VU Meters with PEAK Indicators
These meters indicate the signal levels being fed to the 58's line outputs. The source will be from the line input, reproduction from the record/sync head, or reproduction from the repro head, depending on the setting of the OUTPUT SELECT, REC function and pre-load (SYNC/INPUT) switches.

REAR PANEL

⑲ DBX UNIT CONTROL SIGNAL Connector
A control signal from the 58 is fed to TASCAM's DX-4D dbx Noise Reduction System from this connector. The DX-4D is a 4-channel, simultaneous encode/decode processor, and two DX-4D's are used to provide 8 channels of processing for the 58. A second control cable (from the DX-4D's CASCADE connector) links the two DX-4Ds together to share the control signal from the 58.
NOTE: There is no specific order in which the dbx units must be connected; all channels of processing are identical. The control signal is necessary for use with dbx processors built by TEAC; tape noise reduction units built by dbx also may be used with the 58, in which case this connector is not used.

⑳ SPEED MODE Select Switch
EXT: Connects the SMPTE synchronizer or other synchronizer/controller that's connected to the ACCESSORY connector to control tape speed signal.
INT: Disconnects the external synchronizer/controller. This select switch should be kept in this position when synchronization with associated equipment is not required.

㉑ ACCESSORY (SMPTE) Connector
This "D" connector (multi-pin "business telephone" type) has the necessary inputs and outputs for direct interface with SMPTE time code synchronizers or controllers, including capstan motor tach signal, logic, and tally lines. It is plug-to-plug compatible with BTX, ECCO, CONVERSION, FERNSEH, AUDIO KINETICS or similar synchronizer.
Details concerning physical dimensions, signal distribution and pin connections can be found in the following pages.

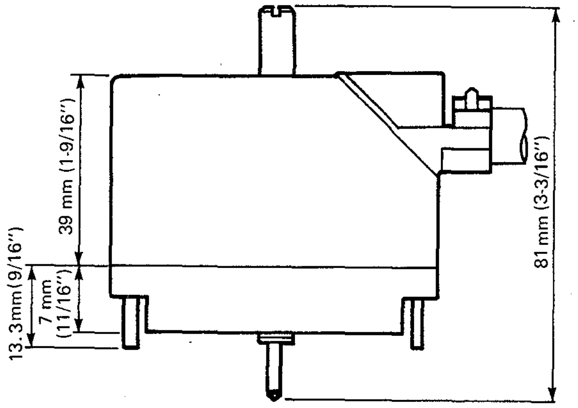
㉒ REMOTE Connector
This connector is used for the optional remote control units: the RC-50 Transport Remote Control (transport controls, auto locator and counter readout), and the RC-51 Full Function Remote Control (transport controls, counter readout, auto locator, OUTPUT SELECT switches, and individual record function (REC ON/OFF) and pre-load (SYNC/INPUT) switches for each track).
NOTE: Transport operations can be simultaneously performed on the 58 and the remote control unit without having to switch between the two units. Change-over between the two units is necessary only for track function switching on the RC-51 (i.e., record function (REC ON/OFF), pre-load (SYNC/INPUT), and OUTPUT SELECT switches). Also, BE SURE THE POWER IS OFF WHEN CONNECTING ANY REMOTE CONTROL UNIT.

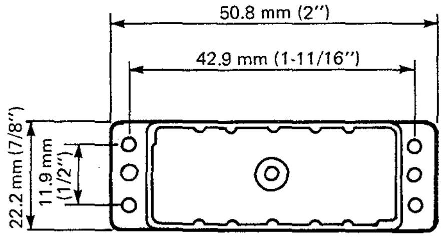
㉓ INPUT Jacks
These 8 unbalanced RCA jacks accept the line inputs to the 58. The nominal signal level is -10 dBV (0.3 V rms), and the load impedance is 50 k ohms.

㉔ OUTPUT Jacks
These 8 unbalanced RCA jacks carry the line outputs from the 58. The nominal signal level is -10 dBV (0.3 V rms), and the minimum load impedance is 10 k ohms.

㉕ AC Power Cord
If your unit is a General Export model, see "Voltage Conversion" on page 4-6.
U.K. customers are requested to refer to "Note for U.K. Customers" of the same page.

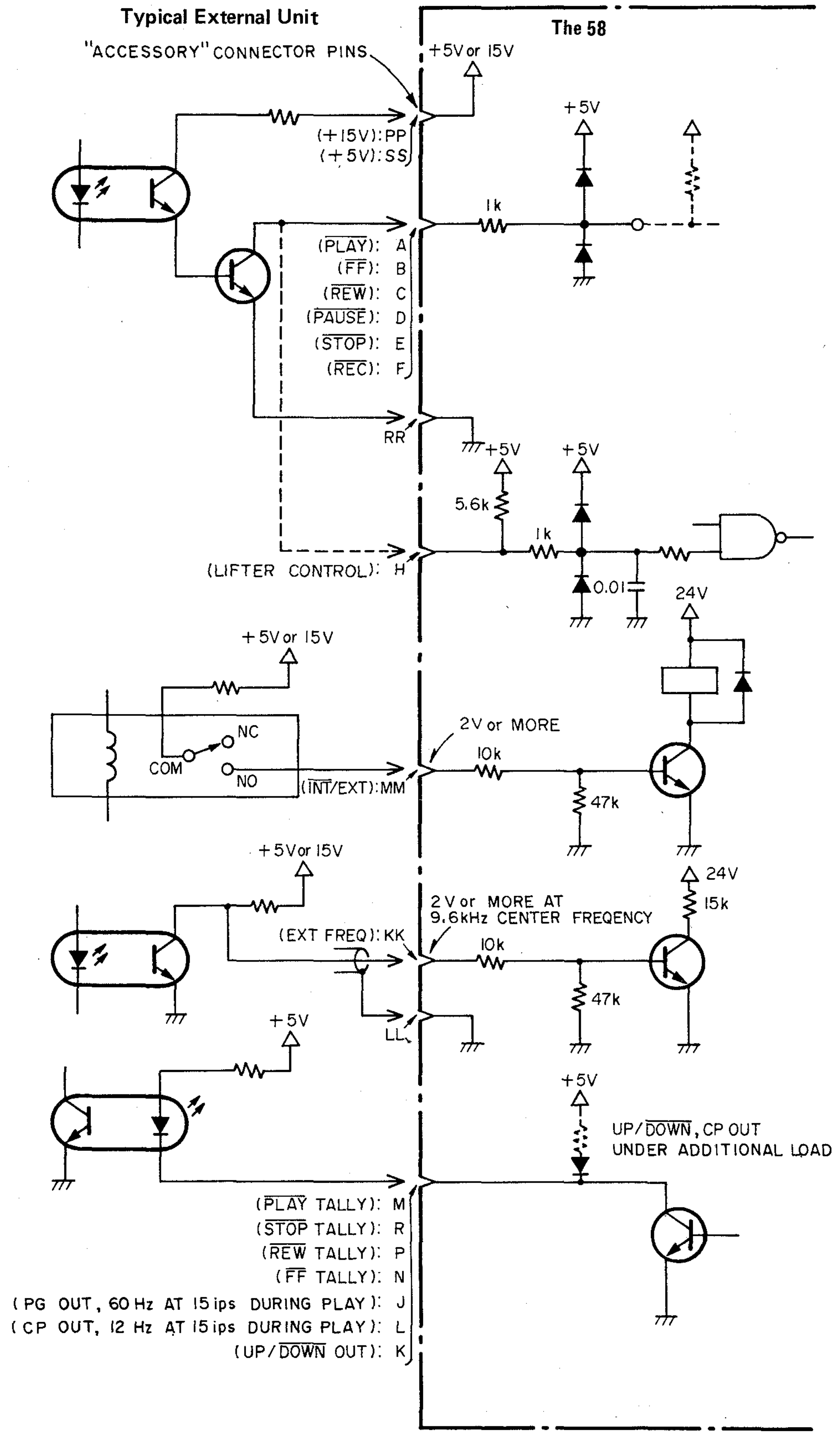
"ACCESSORY" Connector and Signals





Pin #	IN(put)–OUT(put) signals		Function
A	$\overline{\text{PLAY}}$	IN	Inputs PLAY signal at L level.
B	$\overline{\text{FF}}$	IN	Inputs FF signal at L level.
C	$\overline{\text{REW}}$	IN	Inputs REW signal at L level.
D	$\overline{\text{PAUSE}}$	IN	Inputs PAUSE signal at L level.
E	$\overline{\text{STOP}}$	IN	Inputs STOP signal at L level.
F	$\overline{\text{REC}}$	IN	Inputs REC signal at L level.
H	$\overline{\text{LIFTER CONT}}$	IN	Inputs LIFTER shift cancellation signal at L level.
J	PG	OUT	Outputs open-collector signal (60 Hz pulse at 15 ips.)
K	UP/$\overline{\text{DOWN}}$	OUT	Outputs tape running control signal at H or L level.
L	CP	OUT	Outputs open-collector signal (12 Hz pulse at 15 ips.)
M	$\overline{\text{PLAY}}$ TALLY	OUT	Outputs open-collector signal (LOW level during PLAY mode.)
N	$\overline{\text{FF}}$ TALLY	OUT	Outputs open-collector signal (LOW level during FF mode.)
P	$\overline{\text{REW}}$ TALLY	OUT	Outputs open-collector signal (LOW level during REW mode.)
R	$\overline{\text{STOP}}$ TALLY	OUT	Outputs open-collector signal (LOW level during STOP mode.)
S	Open terminal		
T			
U			
V			
W			
X			
Y			
Z			
AA			
BB			
CC			
DD			
EE			
FF			
HH			
JJ			
KK	EXT FREQ	IN (HOT)	Inputs speed control signal at input signal level of 2.0 V or more. (HOT side)
LL	EXT FREQ	IN (COLD)	Inputs speed control signal (COLD side)
MM	$\overline{\text{INT}}$/EXT	IN	Inputs internal/ external speed control select signal Internal: LOW level (0 V) External: HIGH level (2.0 V or more) When "INT/EXT" switch on rear panel is in the "EXT" position.
NN	Open terminal		
PP	+15 V supply voltage	OUT	Maximum: 50 mA
RR	0 V terminal		
SS	+5 V supply voltage	OUT	Maximum: 50 mA
TT	Main unit GND		

"ACCESSORY" Connector Pins and External Signal Connections


Typical External Unit
"ACCESSORY" CONNECTOR PINS
The 58
+5V or 15V
(+15V):PP
(+5V):SS
+5V
1k
(PLAY): A
(FF): B
(REW): C
(PAUSE): D
(STOP): E
(REC): F
RR
+5V
+5V
5.6k
1k
0.01
(LIFTER CONTROL): H
24V
+5V or 15V
NC
COM
NO
(INT/EXT):MM
2V or MORE
10k
47k
+5V or 15V
24V
15k
2V or MORE AT
9.6kHz CENTER FREQENCY
(EXT FREQ):KK
10k
47k
LL
+5V
+5V
UP/DOWN, CP OUT
UNDER ADDITIONAL LOAD
(PLAY TALLY): M
(STOP TALLY): R
(REW TALLY): P
(FF TALLY): N
(PG OUT, 60 Hz AT 15 ips DURING PLAY): J
(CP OUT, 12 Hz AT 15 ips DURING PLAY): L
(UP/DOWN OUT): K

4. OPERATION

4-1. BASIC INFORMATION

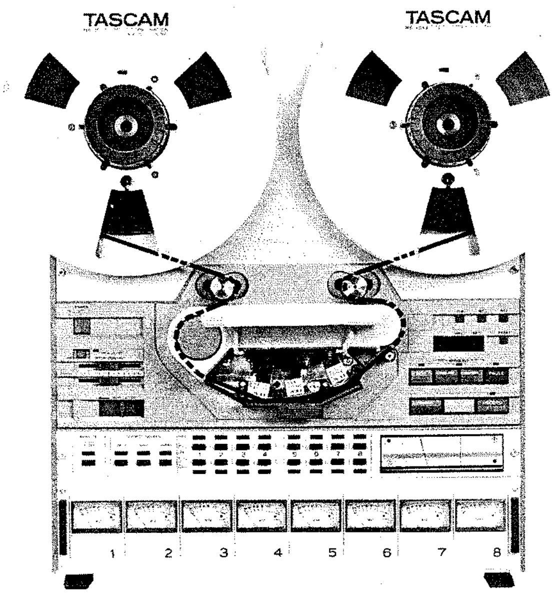
4-1-1. Reel Installation

Use only 10-1/2" reels and 1/2" wide tape. Even with a short tape, use 10-1/2" reels on both the supply and takeup reel tables, since the servo system is balanced to provide proper tension based on this reel size.

4-1-2. Threading Tape

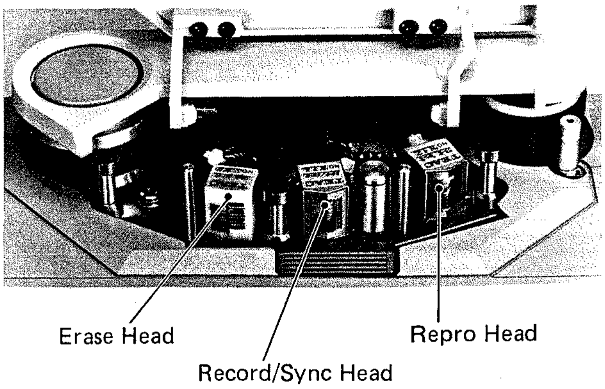
Lift the head access cover and press in on the head shield (head gate) to gain access to the heads for threading tape. Thread the tape as shown in the illustration below.

NOTE: If the tape has been stored "tails out" (a recommended practice), remember to place it on the takeup reel table and to rewind it onto the supply reel prior to use.



4-1-3. Erasing the Tape

A previously recorded track is automatically erased when you make a new recording on it. However, if an entire tape is to be erased, we recommend using a bulk eraser such as the TEAC E-2A. This is faster and more convenient than erasure at 15 ips. If a tape is to be reused, the initial bulk erasure combines with the track-by-track erasure which occurs during recording to provide a more thorough erasure for optimum signal-to-noise ratio.



4-1-4. Cleaning and Demagnetizing

Clean and demagnetize all components in the tape path as described in the "Routine Maintenance" section of this manual.

4-2. OPERATING PROCEDURES

The following general information is applicable to all operating modes.

1. If the tape runs completely off the supply or takeup reel, the recorder/reproducer automatically stops and enters the unthread mode, and the tape timer display stops.
2. The two following groups of functions are mutually exclusive such that only one group may be selected at a time:
   a) Record, record ready or play
   b) SYNC, REPRO or INPUT

4-3. MONITORING THE LINE OUTPUTS

The OUTPUT SELECT switches determine the source of the signals present at the output terminals. INPUT always selects the input jacks as a source, and REPRO always selects the repro head as the source, but SYNC may select either the input jacks or sync reproduction from the record/sync head, depending on the setting of the REC function switches, the pre-load (SYNC/INPUT) switches, and other operating controls. The table below graphically depicts the output source.

Determining the signal source for the 58's output*

OUTPUT SELECT Switch	REC Function Switch	Pre-load (SYNC/INPUT) Switch	RECORD Switch	Operating Mode	LINE OUTPUT Source
REPRO (▭)	–	–	–	–	Repro Head
INPUT (▭)	–	–	–	–	Line Input
SYNC (▭)	OFF (□)	–	–	–	Sync Repro
	ON (▭)	INPUT (□)	–	–	Line Input
		SYNC (▭)	OFF	In Stop, Fast Winding Modes, or RTZ or STC	Line Input
				In Play, Pause, Edit and Cue Modes	Sync Repro
			ON	–	Line Input
LED on above the switch pressed.	LED flashes with RECORD switch off, and stays on with RECORD switch on.	LED is on with RECORD switch off, and is off with RECORD switch on.	LED flashes with REC function switch off, and is on with REC function on.		

* "–" signifies that the setting of this switch or the operating mode has no effect on the line output source.

4-4. RECORDING

Prior to recording, check to see that the 58 is properly wired to the recording mixer and associated equipment. Remember that the recording level is controlled at the output of the mixer, not on the 58. Initially, we suggest setting the 58 as listed:

Switch	Setting	Indicator
OUTPUT SELECT	INPUT (to preset the record level) or SYNC (to monitor playback until recording begins)	LED turns on adjacent to corresponding switch
REC function	For those tracks to be recorded, press in on the switch to turn on the channel.	LED(s) turn on corresponding to tracks to be recorded.
Pre-load (SYNC/INPUT)	INPUT	–

4-4-1. Entering Record from Record/Pause Mode

Simultaneously press the RECORD and PAUSE buttons to place the machine in record/pause mode. The RECORD LED will begin flashing if none of the REC function switches are engaged; if any REC function switch is engaged, the RECORD LED will stay on.

To begin recording on those channels whose REC function switches are engaged, press the play (▶) button. The REC function LED will stop flashing and will stay on continuously, and the pre-load (SYNC/INPUT) LED will turn off as record mode is entered. Press STOP to end the recording and stop tape.

4-4-2. Entering Record from Stop Mode

The REC function, OUTPUT SELECT and pre-load (SYNC/INPUT) switches may be set as in the previous section. Instead of placing the machine in record/pause mode, however, simply press RECORD and play (▶) simultaneously to directly enter record mode from the stop mode.

4-4-3. Punch-In Using the REC Function Switches

Set the OUTPUT SELECT switches and pre-load (SYNC/INPUT) switch to the SYNC position, and turn off all REC function switches (unless you want a track to begin recording immediately). Now simultaneously press the RECORD and play (▶) buttons to place the machine in record ready mode. Tape will be rolling, but the track(s) will not be recording. You can "punch in" to record on a particular channel by pressing in its REC function switch. To "punch out" of record on that channel, release its REC function switch. To "punch out" of record on all channels, press STOP or simultaneously press the RECORD and (▶) buttons.

4-5. EXAMPLES OF PUNCH-INS AND INSERTS

Consider two different situations where it is desirable to re-record portions of a track rather than recording the entire part all over again.

EXAMPLE 1:

Suppose there is a hesitant start at the beginning of a tune, one slightly out of time with the downbeat. In order to make a correction at this point, there is no need to monitor the playback (sync) from the problem track. In fact, the "bad start" may only serve to confuse the performer. To punch in on the track, set the corresponding REC function switch on, then press the RECORD and play (▶) buttons after hearing the slate at the beginning of the tune. To end the insert, press STOP.

EXAMPLE 2:

Suppose an error is made in the middle of or near the end of a tune. Now the performer will need to hear his performance up to the "problem" point so that the punch-in (an "insert") will have the same style and feel as the existing track. In this instance, leave the REC function switches off and press the RECORD and play (▶) buttons to begin playing the tape. The outputs will carry playback from the record/sync head, and the performer may be playing along with this sync playback to "warm up." At the moment the insert is to be made, engage the track's REC function switch to begin recording. Two things then occur: (1) you instantly enter record mode on the track so the new part will replace the previous portion of the track (in sync), and (2) the output is automatically switched from tape playback to input source so the performer can hear the new part as it is being added.

4-6. ANOTHER LOOK AT SYNC FUNCTIONS

Since the sync mode allows "in synchronization" recording of new signals with previously recorded tracks, it serves as a means to perform overdubbing as well as normal recording. When the machine is in the sync mode, the performer can monitor the previously recorded tracks via playback through the record/sync head while, at the same time, his new part is being added on another track (or tracks) of the same head.

For example, suppose we load a tape on which three tracks are already recorded, and the other five tracks are blank. In sync mode, the three existing tracks are played back, mixed at the console, and fed to the performer's cue headphones. The performer now monitors that mixed signal from the three tracks while he records new a signal on one (or several) of the formerly blank tracks. Since the same head is used for playback and recording, all the signals remain "in sync" for proper playback.

When making an overdub or an insert, the performer can begin playing prior to the actual initiation of recording, allowing time for him to "get up to speed" and play along with the existing tracks. At the time the punch-in is made, the signal being monitored by the performer instantly and automatically changes from playback of the existing track (which is to be re-recorded) to the input to that track as it is being re-recorded. Monitoring is unchanged on those tracks which are not being re-recorded.

4-7. BUILT-IN AUTO LOCATOR FUNCTIONS

The 58 has a digital counter which indicates the elapsed tape running time from 00 minutes, 00 seconds ("00.00") up to a maximum of 99 minutes, 59 seconds ("99.59") – not that you can get a 100 minute tape to fit on the machine. From any mode, the 58 can be made to fast wind (forward or reverse) to a "00.00" counter readout by pressing the RTZ button. Additionally, the counter has an associated memory register that allows any specific time on the tape to be "remembered" by pressing the CUE button as that point is displayed on the counter. The tape can then be made to fast wind (forward or reverse) to the memorized cue point by pressing the STC button – again, from any mode.

When the RESET button is pressed, the 58's digital display will indicate "00.00." So, too, will the counter display on any remote control unit that may be plugged into the 58.

4-8. FAST WINDING

To fast wind a tape in the forward direction (onto the takeup reel) or reverse direction (onto the supply reel), press the fast forward (▶▶) or rewind (◀◀) button. These fast winding modes can be initiated from the stop, play or record modes. The tape lifter arms pull the tape away from the heads as soon as fast winding is initiated, and the line outputs are also electronically muted. To monitor the tape during fast winding, slide the TAPE LIFTER lever towards the left.

4-9. REPRODUCTION (PLAYBACK)

Thread a recorded tape onto the 58, and set the following controls as indicated:

POWER Switch:	On
OUTPUT SELECT Switch:	SYNC or REPRO
REC Function Switches:	All channels off (buttons up)

Then press the play (▶) button. Tape will run onto the takeup reel at 15 ips (38 cm/sec), assuming the PITCH CONTROL switch is not engaged, and the line outputs will carry the reproduced signal from the tape. Press STOP to stop the tape and end this mode.

4-10. EDITING

NOTES:

1. When splicing tape, never use ordinary adhesive or pressure sensitive tape. Use only special tapes made for splicing (editing) recording tape. Splicing tape has a small amount of low-tack adhesive which is adequate to grip the backing of the recording tape, yet which will not "ooze" out beyond the splice after being wound under tension and shuttled over the heads. Conventional tape almost always "leaks" adhesive onto the heads and onto adjacent windings of tape on the reel.
2. Always use non-magnetic tools, including razor blades, when splicing tape. Magnetized tools will cause a "click" upon playback.

4-10-1. Manual Editing (STOP/EDIT)

To locate a cue point, use the TAPE LIFTER lever during the fast winding or spooling mode, then press STOP. Once the approximate cue point is thus located, and tape is stopped, press the EDIT button; an LED lights, and the tape reels may then be "hand rocked" to find the exact cue point. (Note the tape counter still operates.) When that point is heard to play back: flip up the head access cover, push in on the head shield (if it is up), and use a grease pencil (a "china marker") to mark the cut point opposite the head through which you are listening (the record/sync head if OUTPUT SELECT is set to SYNC, or the repro head if set to REPRO).

4-10-2. Dump Editing (Play (▶)/EDIT)

Once the initial cue point is marked, pull tape forward and lay it into the splicing block (oxide down) and cut the tape diagonally at the mark using a non-magnetic single-edged industrial razor blade. If a substantial length of tape is to be removed, rethread the tape from the supply reel past the heads, capstan and pinch roller . . . and let the end hang off the right side of the transport. Then, press the EDIT button and the play (▶) button simultaneously. Tape will begin unthreading itself (dumping) from the supply reel as you listen to it play, and the takeup reel will not turn to take up slack; tension arm positions are disregarded by the transport logic. When you reach the next edit point, press STOP. Once again, press EDIT and manually move the tape so the splice point is opposite the head being used for reproduction, mark that point, and make the second diagonal cut. Then butt the two cut ends from the supply and takeup reels, apply a small piece of splicing tape, and trim the excess along both edges of the recording tape.

NOTES:

1. If the play (▶) button is pressed alone, after the EDIT LED is on, the unit will go into play mode and the EDIT LED will turn off. To enter "dump edit" mode, both the EDIT and (▶) buttons must be pressed at the same time.
2. If the STOP button is pressed during dump edit mode, the edit mode will be disengaged and tape will stop.

4-11. SPOOLING

The spooling mode is used to transfer tape from one reel to the other at a constant speed of approximately 80 ips (203 cm/sec) to obtain a tight, uniform tape pack . . . as compared to approximately 240 ips (610 cm/sec) for normal fast wind speed. Generally, spooling will be done onto the takeup reel at the end of a recording or editing session so the tape can be stored "tails out," which reduces audible print-through effects (pre-echoes). Fast winding is not used here because the tape pack is less uniform, and edge damage to the tape is therefore more likely during storage. When the tape is again to be used, it is first rewound onto the supply reel at normal rewind speed. It may be helpful to use a white leader tape at the head (beginning) of the tape, and a red leader tape at the tail (end) of the tape to avoid any possible confusion as to which end is which.

To select the forward spooling mode press the fast-forward (▶▶) button once to begin fast forward winding. Then immediately press it a second time; this initiates the forward spooling mode and turns on the green SPOOLING LED. A third pressing of the (▶▶) button will return the transport to normal fast-forward winding, or pressing STOP will stop any tape motion.

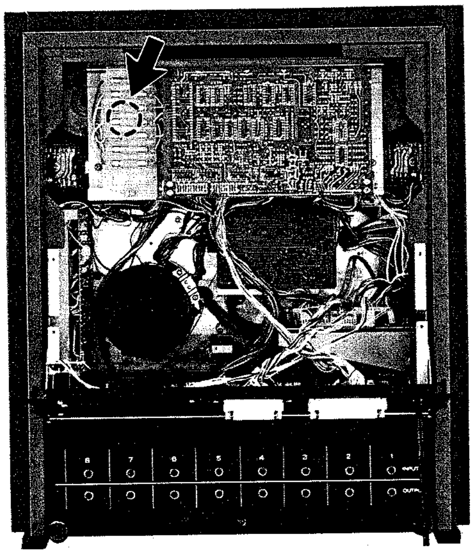
To select the reverse spooling mode, press the rewind (◀◀) button twice consecutively. Just like (▶▶), a third pressing of the this button will cause the transport to return to normal rewind speed, and pressing STOP will disengage spooling mode and stop all tape motion.

4-12. VOLTAGE CONVERSION

The 58 is factory pre-set to operate at the AC line voltage specified on the reel tag and on the packing carton.

NOTE: Field conversion of this line voltage to other voltages is not possible on models sold in the U.S.A., Canada, the U.K., Australia or Europe. If your 58 is a "general export" model and it does become necessary to change the line voltage requirements to suit local AC power mains, use the following procedures.
ALWAYS DISCONNECT THE POWER CORD BEFORE OPENING THE UNIT.

1. Disconnect the 58's power cord from the AC outlet.
2. Using an ISO Phillips screwdriver, remove the upper rear panel and the 2 screws on the FUSE PCB assembly.
3. Locate the voltage selector behind the FUSE PCB Ass'y. Refer to page 7-2.
4. To increase the selected voltage, turn the slotted center post clockwise using a regular (slot blade) screwdriver; to decrease the voltage, turn the post counterclockwise. The numerals which appear in the cut-out window of the voltage selector designate the selected AC line voltage.



NOTE: If you cannot obtain the desired line voltage numerals in the window as you turn the selector, your recorder/reproducer must be taken to an authorized TEAC Service Facility for voltage conversion.

5. Replace the 2 screws on the FUSE PCB Ass'y, and reinstall the rear cover panel.
6. Make a clearly visible marking or attach a tag to the machine indicating it has been set for the new line voltage.

4-13. NOTE FOR U.K. CUSTOMERS

U.K. Customers Only:
Due to the variety of plugs being used in the U.K., this unit is sold without an AC plug. Please request your dealer to install the correct plug to match the mains power outlet where your unit will be used as per these instructions.

IMPORTANT

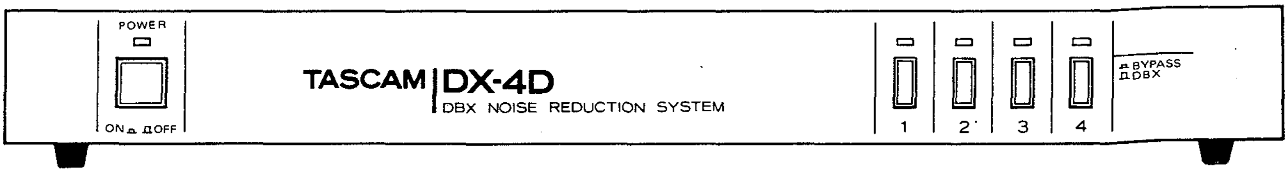
The wires in this mains lead are coloured in accordance with the following code:

BLUE:	**NEUTRAL**
BROWN:	**LIVE**

As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals of your plug, proceed as follows.

The wire which is coloured BLUE must be connected to the terminal which is marked with the letter N or coloured BLACK. The wire which is coloured BROWN must be connected to the terminal which is marked with the letter L or coloured RED.

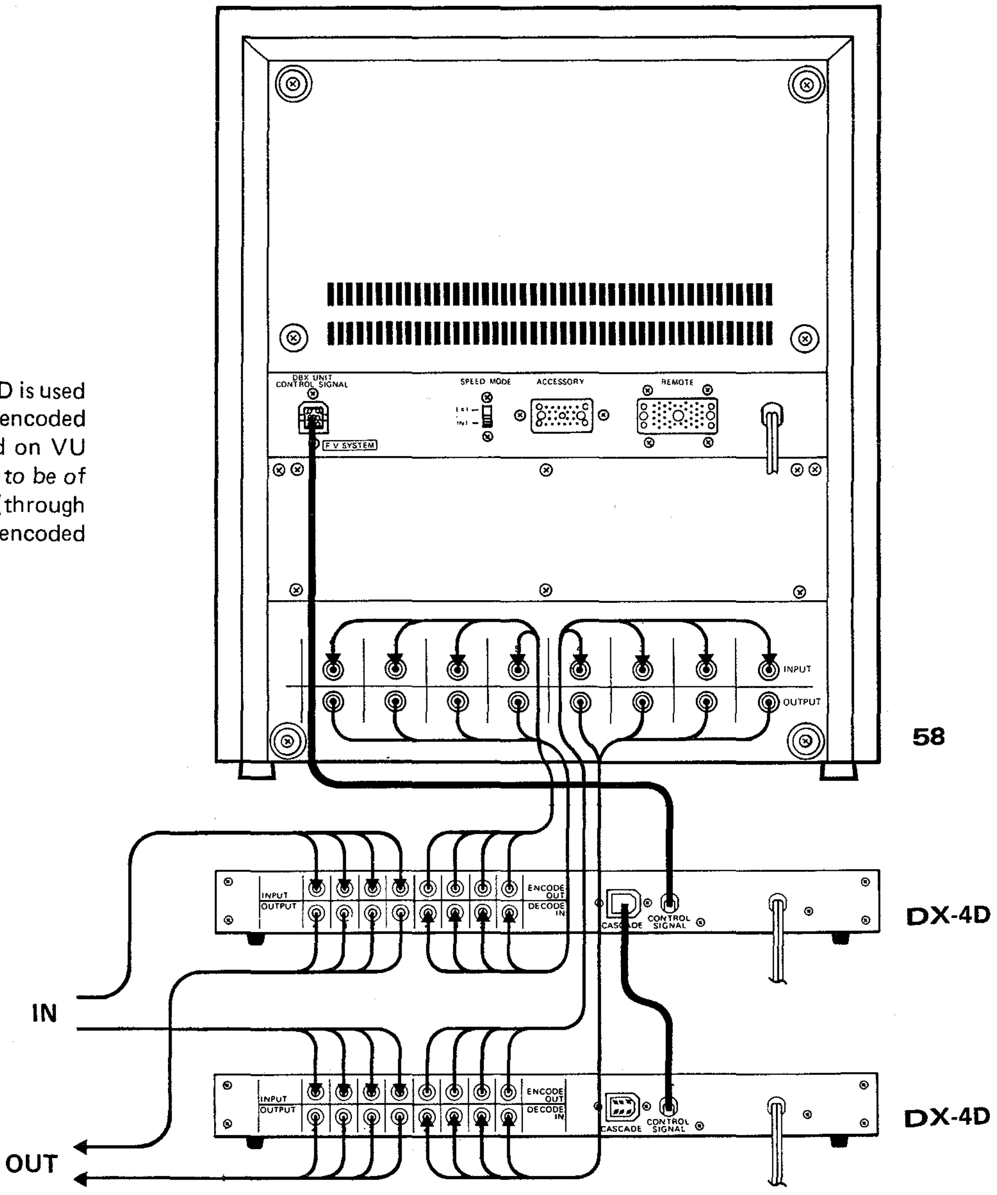
4-14. CONNECTION AND OPERATION OF THE DX-4D


POWER
ON OFF
TASCAM DX-4D
DBX NOISE REDUCTION SYSTEM
1
2
3
4
BYPASS
DBX

Hook up

Because the DX-4D is a 4-channel dbx system, it is necessary to connect two of the DX-4D's to facilitate the 58's eight channel function. There is no specific order in which the two units are to be connected, but be consistent or you may become confused. Make sure that each track ENCODE/DECODE pair is connected to the same section, or your bypass switch functions will not work properly.

Note: When the DX-4D is used together with the 58, encoded signal levels displayed on VU meters will be found to be of somewhat less value (through compression) than no-encoded signal levels.


DBX UNIT CONTROL SIGNAL
F.V SYSTEM
SPEED MODE
ACCESSORY
REMOTE
INPUT
OUTPUT
58
INPUT
OUTPUT
ENCODE OUT
DECODE IN
CASCADE
CONTROL SIGNAL
DX-4D
DX-4D
IN
OUT

DBX Bypass Switch

1. With this DBX NOISE REDUCTION SYSTEM, both ENCODE/DECODE are in operation while this switch is in the (◻ DBX) position. With this switch in the (▭ BYPASS) position, the DBX circuit is bypassed, which deactivates ENCODE/DECODE. The switches for each channel (1 – 8) work independently to facilitate separate functioning.
2. With this switch in the (▭ BYPASS) position, the LED cuts off, and the DBX circuit is bypassed. Keep this switch in this position when not using the DBX NOISE REDUCTION SYSTEM.

How the DX-4D functions

The DX-4D functions only when connected to the DBX UNIT CONTROL SIGNAL terminal of the 58.

Once the DX-4D has been connected, you may virtually ignore it. The unit is completely automatic. And, because of the design and nature of this noise reduction system, there is no need for record or reproduce level match adjustments – the level is non-critical within nominal tolerances; the circuit is stable.

Since decode and encode functions are actuated by the respective channels of the DX-4D, simultaneous dbx NR Encoding/Decoding is possible without having to switch between ENCODE or DECODE.

EXAMPLE 1.

Original Recording

Suppose you are going to record, with OUTPUT SELECT and pre-load (SYNC/INPUT) switches in the SYNC position, depress REC function switches 1 thru 4. LED indicators will light, signaling ready-to-record on those tracks.

An encoded signal will be automatically reproduced when the 58 is started because of the DX-4D's ability to simultaneously encode and decode while the DBX switch is in the (◻ DBX) position.

EXAMPLE 2.

Overdubbing

In this example, suppose you have recorded on tracks 1 thru 4, and now wish to record on tracks 5 thru 8, in sync.

Set up the OUTPUT SELECT, pre-load (SYNC/INPUT) and REC function switches in the same manner as in Example 1. The DX-4D will automatically encode the signals going to tracks 5 thru 8, and decode the signals on tracks 1 thru 4.

The same process occurs when you punch-in during any recording session. When the 58 is in the record mode, the DX-4D is encoding; in reproduce (sync monitoring), it's decoding.

HOW THE DX-4D WORKS

The DX-4D is a wide-band compression-expansion system which provides a net noise reduction (broadband, not just hiss) of a little more than 30 dB. In addition, the compression during recording permits a net gain in tape headroom of about 10 dB.

A compression factor of 2:1 is used before recording; then, 1:2 expansion on reproduce. These compression and expansion factors are linear in decibels and allow the system to produce tape recordings with over a 100 dB dynamic range – an important feature, especially when you're making live recordings. The DX-4D employs RMS level sensors to eliminate compressor-expander tracking errors due to phase shifts in the tape recorder, and provides excellent transient tracking capabilities.

To achieve a large reduction in audible tape hiss, without danger of overload or high frequency self-erasure on the tape, frequency pre-emphasis and de-emphasis are added to the signal and RMS level sensors.

If you're an electronic engineer, all of the above gab may tell you the whole story of what's going on inside the DX-4D, but if you're not, to make things a little easier to understand we'll ask you to use your imagination.

Imagine four little recording engineers in the box with each of their hands on a volume control. They are incredibly fast but very stupid, so you must give them a set of rules. You tell them to raise signals that are below "0 VU", and reduce signals that are higher than "0 VU".

The lower the signal is, the more they raise it, and the higher levels above "0 VU" get lowered more and more as they go up in level past "0". This is the 2:1 compression. You also tell them to call "0.316 V" "0 VU". Here they do nothing, no change except frequency pre-emphasis or boost. Since you know they are going to keep the high levels under control, you can raise the "top end" a bit and still not overload the tape.

Just to keep it simple for them, the boost in highs is fixed. They put it in all the time, no matter what level changes they are making. Now we play tape back, and say OK, do everything backwards. Levels above "0.316 V" "0 VU" are raised and levels below "0.316 V" are lowered, and while you're at it, fellows, take off the extra top end as well. Follow the rules in reverse. As long as you don't confuse them by shifting the "0 VU" point, they work just great, but – don't put in more than "0.316 V" as zero VU, and don't make the tape playback zero anything other than "0.316 V" either. As we said they're very dumb and will follow instructions very precisely. Differing levels will produce decoding errors.

The reason these errors may not be objectionable is that people could have played or sung or whatever with a little more or less dynamics. A small change won't be as noticeable as a mistake, but it is not perfect. The tolerance here is not electronic, it's human. To get exactly what you put in, it is necessary to get an exact "0 VU", 0.316 V in and out. The system is level sensitive although it is realistic to say it is "artistically" foregiving.

One common mistake we find, is that people don't check the OUTPUT voltage of the mixer or other device feeding the DX-4D, and don't remember that the DX-4D is the first item in the system (58/DX-4D). "Breathing" and "pumping" can result especially on instruments like piano and acoustic guitars, if the levels are seriously mismatched, because of the way the DX-4D works. If your mixer "0" VU is not 0.3 volt, (the DX-4D "standard zero") the code process will reflect the fact that all levels are higher (if the mixer "zero" is 1 volt.) Now, when you DECODE, the troubles start. The 58 playback electronics cannot safely be set to this "high" output level, and the decoder will not "see", the same levels in playback. Decode errors will occur.

Consider also the fact that the DX-4D will increase your signal to noise ratio by 30 dB. If you record at a generally lower level you will avoid dbx problems and still have quiet tapes. Try using -5 or -7 VU as "zero".

Mixing

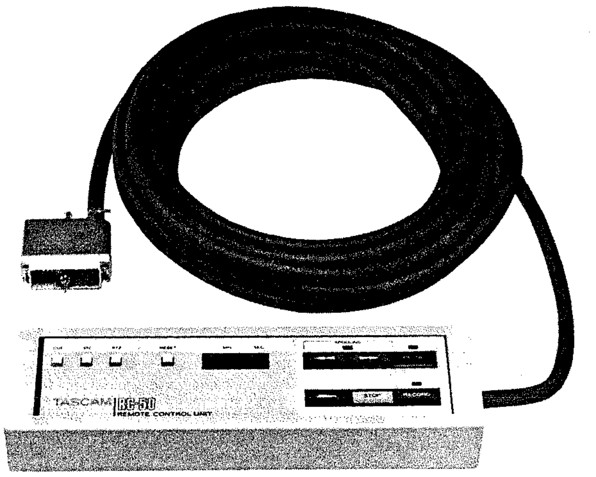
Program material must be in uncompressed form for mixing and sound-on-sound recording. You must first decode the program material which has been encoded by the DX-4D in order to mix it with any other material –compressed or uncompressed. Of source, mixed material may be compressed again for recording. If this precaution is not followed, you'll get cross-modulation of the separate signals or tracks.
The little guys in the box will look at their "chart" and give you some really entertaining level shifts, as we have said, they're fast but dumb.

Subsonics and Interference

The DX-4D incorporates an effective bandpass filter with -3 dB response at 20 Hz and 30 kHz. This filter suppresses undesirable sub- and supersonic frequencies to keep them from introducing errors into the encode or decode process. However, if rumble from trains or trucks is picked up by your microphone and fed to the DX-4D – filters are not perfect – modulation of the program material during low level passages may occur. This low frequency component will not itself be passed through the recorder and so, will not be present at reproduce for proper decoding. If this low level decoding error is encountered, and subsonics are suspected, we suggest the addition of a suitable high pass filter ahead of the DX-4D and after the mic preamplifier for further attenuation of these subsonic frequencies.

4-15. OPTIONAL EQUIPMENT AND USEFUL ACCESSORIES

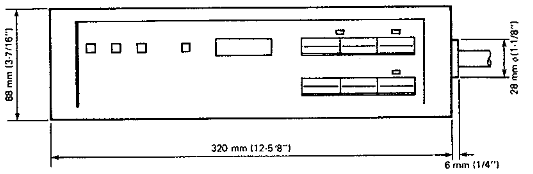
RC-50 Remote Control Unit

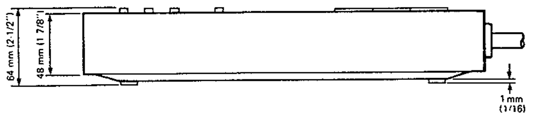


The RC-50 is designed for remote control of the transport, auto locator and counter read-out functions.

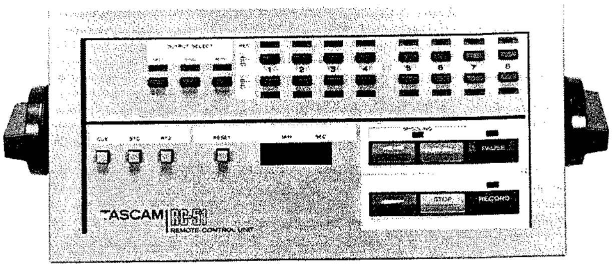
SPECIFICATIONS

Functions	
Transport:	Play (▶), STOP, fast-forward (▶▶), rewind (◀◀), spooling, RECORD and PAUSE
Tape Counter:	4-digit, minute and second read-out, with RESET button
Auto Locator:	CUE, Single-point memory RTZ, Return-To-Zero STC, Search-To-Cue
Dimensions (W x H x D)	320 x 48 x 88 mm (12-5/8" x 1-7/8" x 3-7/16"), not including connector and switches
Weight	Approx. 2.7 kg (5-15/16 lbs), including cable





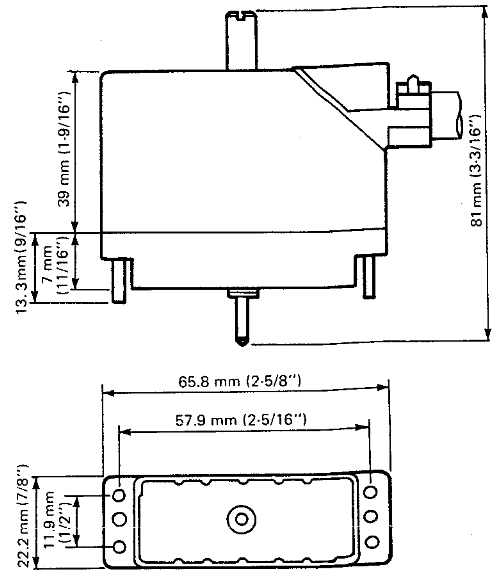
RC-51 Remote Control Unit

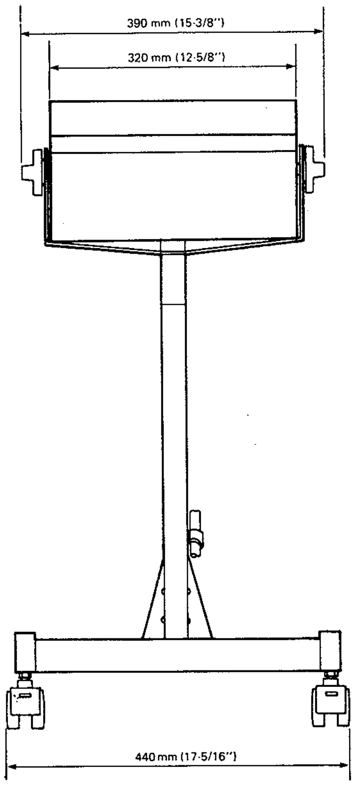


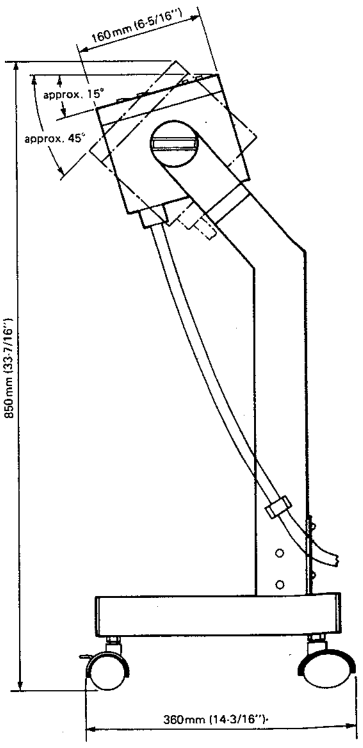
The RC-51 is a full function remote control unit provided with a roll-around stand, and allows remote operation of the 58 from as far away as 8 meters. All transport controls (except EDIT) and front panel functions, including auto-locator, counter read-out, OUTPUT SELECT, pre-load (SYNC/INPUT) and record (REC ON/OFF) functions of the 58 can be remote-controlled from this control unit.

SPECIFICATIONS

Description	Remote control unit with provided roll-around stand
Function	
Transport:	Play (▶), STOP, fast-forward (▶▶), rewind (◀◀), spooling, RECORD and PAUSE
Tape Counter:	4-digit, minute and second read-out, with RESET button
Auto Locator:	CUE, Single-point memory RTZ, Return-To-Zero STC, Search-To-Cue
OUTPUT SELECT:	INPUT, SYNC and REPRO
REC Function:	Channel 1 – 8
Pre-Load (SYNC/INPUT):	Channel 1 – 8
Construction	
Main Unit:	Metal (with angle adjust)
Stand:	Metal
Connecting Cable:	8 m, 5-core shielded, with 56 pin connector (Marco 354)
Dimensions (W x H x D)	320 x 850 x 360 mm (12-5/8" x 33-7/16" x 14-3/16")
Weight	Approx. 12 kg (26-7/16 lbs), including cable

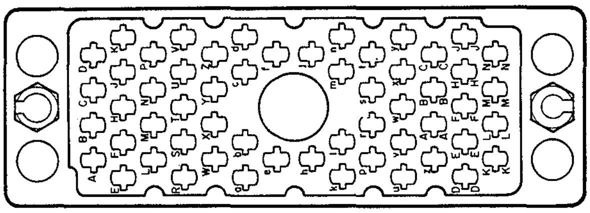

39 mm (1-9/16")
13.3mm (9/16")
7 mm (11/16")
81 mm (3-3/16")
65.8 mm (2-5/8")
57.9 mm (2-5/16")
22.2 mm (7/8")
11.9 mm (1/2")


390 mm (15-3/8")
320 mm (12-5/8")
440 mm (17-5/16")


160 mm (6-5/16")
approx. 15°
approx. 45°
850 mm (33-7/16")
360mm (14-3/16")

Configurations are subject to change without notice or obligation.

"REMOTE" Connector Signals

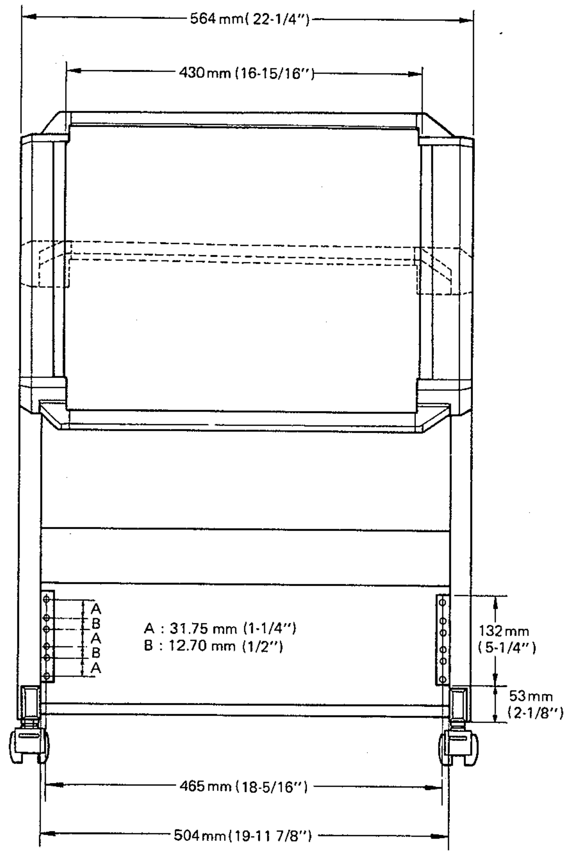


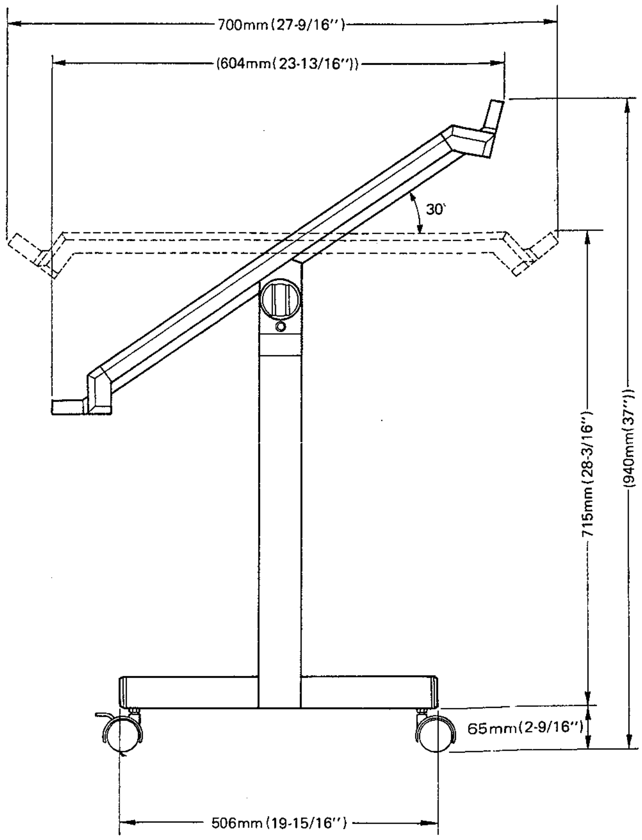
Pin #	IN(put)–OUT(put) signals		Function
A	(–) SIGN	OUT	Outputs counter display signal (Connected in parallel to deck)
B	P3	OUT	
C	P2	OUT	
D	P1	OUT	
E	P0	OUT	
F	$\overline{\mathrm{a}}$	OUT	
H	$\overline{\mathrm{b}}$	OUT	
J	$\overline{\mathrm{c}}$	OUT	
K	$\overline{\mathrm{d}}$	OUT	
L	$\overline{\mathrm{e}}$	OUT	
M	$\overline{\mathrm{f}}$	OUT	
N	$\overline{\mathrm{g}}$	OUT	
P	$\overline{\mathrm{PLAY}}$	IN	Inputs transport control signal (Via interface circuit)
R	$\overline{\mathrm{FF}}$	IN	
S	$\overline{\mathrm{REW}}$	IN	
T	$\overline{\mathrm{PAUSE}}$	IN	
U	$\overline{\mathrm{STOP}}$	IN	
V	$\overline{\mathrm{REC}}$	IN	
W	$\overline{\mathrm{RESET}}$	IN	
X	$\overline{\mathrm{RTZ}}$	IN	
Y	$\overline{\mathrm{CUE}}$	IN	
Z	$\overline{\mathrm{STC}}$	IN	
a	$\overline{\mathrm{REC\ LED}}$	OUT	Outputs remote-control indicating signal (Connected in parallel to deck)
b	$\overline{\mathrm{PAUSE\ LED}}$	OUT	
c	$\overline{\mathrm{SPOOL\ LED}}$	OUT	
d	UP/$\overline{\mathrm{DOWN}}$	OUT	Outputs service signal
e	CP	OUT	
f	$\overline{\mathrm{REMOTE\ LOW}}$	IN	
h	Open terminal	IN	
i	+5 V supply voltage	OUT	

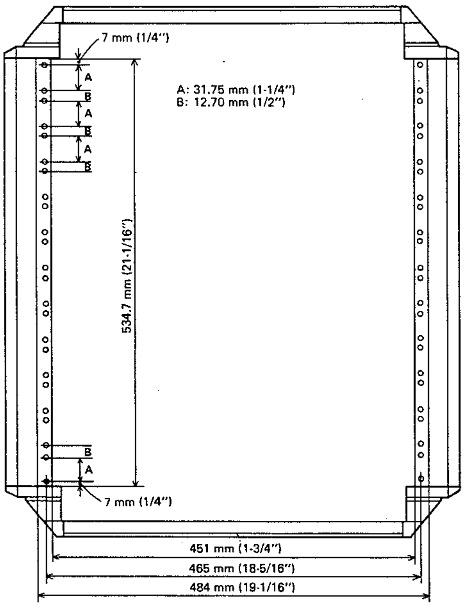
Pin #	IN(put)–OUT(put) signals		Function
k	0 V (+5 V Vcc)		
l	↑		
m			
n	Open terminal		
p			
r			
s	↓		
t	+15 V supply voltage	OUT	
u	MUTE	IN	FUNCTION Input/Output signal (For conversion between the remote control unit and deck)
v	SYNC	IN	
w	$\overline{\mathrm{CH\text{-}1}}$	IN	
x	$\overline{\mathrm{CH\text{-}2}}$	IN	
y	$\overline{\mathrm{CH\text{-}3}}$	IN	
z	$\overline{\mathrm{CH\text{-}4}}$	IN	
AA	$\overline{\mathrm{CH\text{-}5}}$	IN	
BB	$\overline{\mathrm{CH\text{-}6}}$	IN	
CC	$\overline{\mathrm{CH\text{-}7}}$	IN	
DD	$\overline{\mathrm{CH\text{-}8}}$	IN	
EE	INPUT	IN	
FF	REC MODE	IN	
HH	FUNCTION LED	OUT	
JJ	PRE-LOAD LED	OUT	
KK	PLAY MUTE	OUT	
LL	0 V (+15 V Vcc)		
MM	Open terminal		
NN	Main body GND		

CS-607 Console Rack (EIA 19-inch)

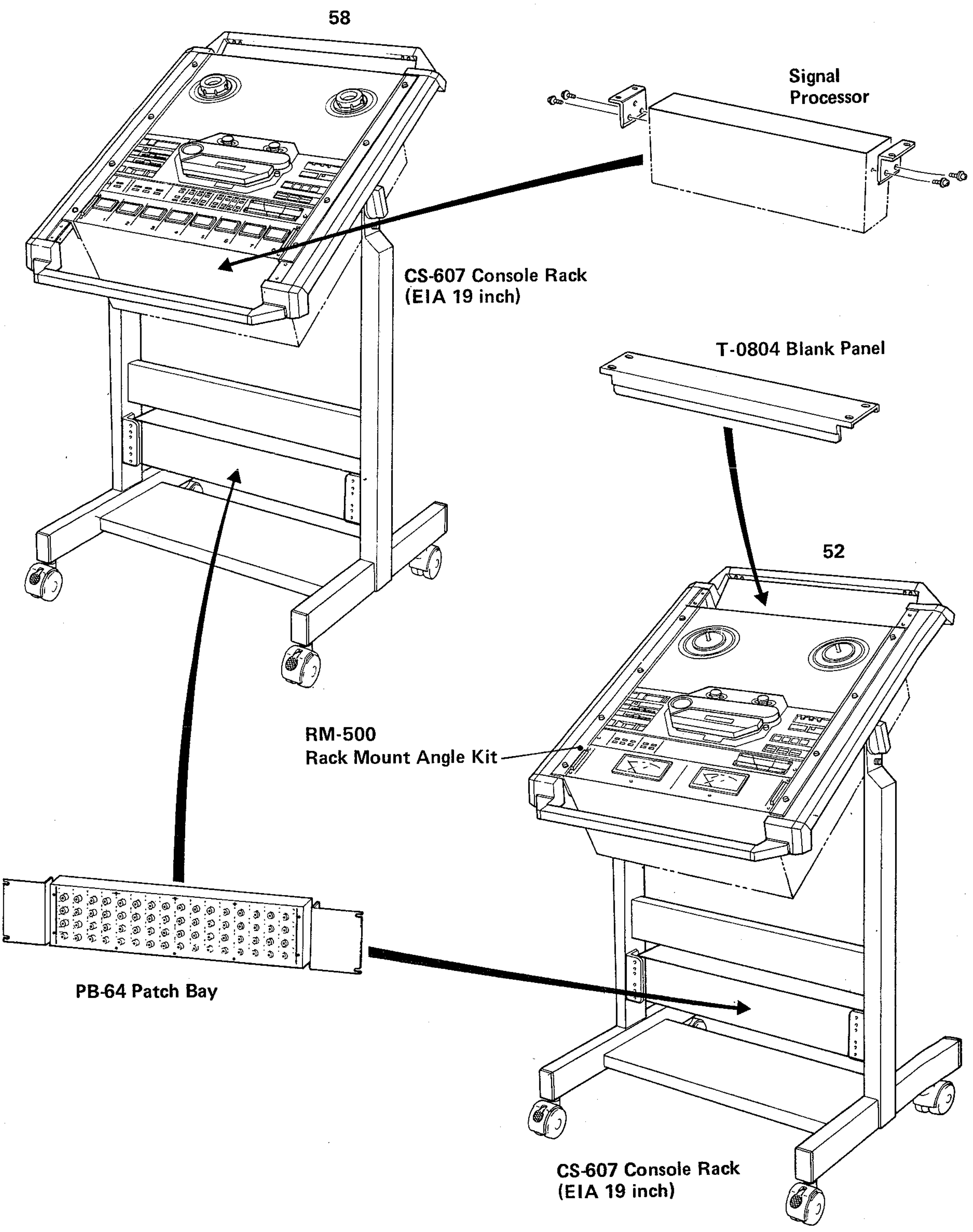
The CS-607 is a standard 19-inch console rack to be used with the RM-500 for mounting of the TASCAM 58.


564 mm(22-1/4")
430mm (16-15/16")
A
B
A
B
A
A : 31.75 mm (1-1/4")
B : 12.70 mm (1/2")
132mm
(5-1/4")
53mm
(2-1/8")
465mm (18-5/16")
504mm(19-11 7/8")


700mm(27-9/16")
(604mm(23-13/16"))
30°
715mm(28-3/16")
(940mm(37"))
65mm(2-9/16")
506mm(19-15/16")

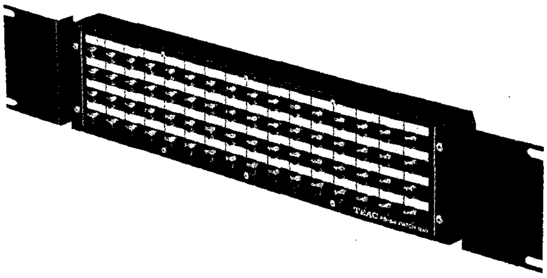

7 mm (1/4")
A
B
A
B
A
B
A: 31.75 mm (1-1/4")
B: 12.70 mm (1/2")
534.7 mm (21-1/16")
B
A
7 mm (1/4")
451 mm (1-3/4")
465 mm (18-5/16")
484 mm (19-1/16")

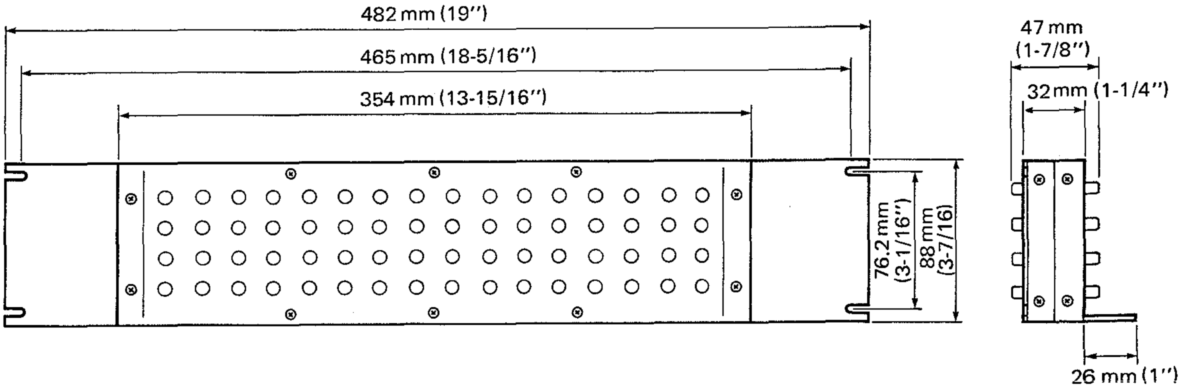
Mounting Application Example using the CS-607

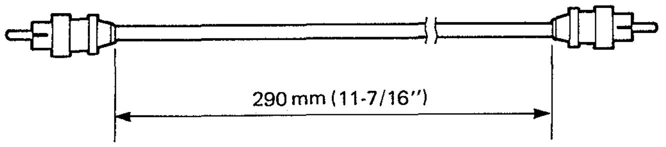

58
Signal Processor
CS-607 Console Rack (EIA 19 inch)
T-0804 Blank Panel
52
RM-500 Rack Mount Angle Kit
PB-64 Patch Bay
CS-607 Console Rack (EIA 19 inch)

PB-64 Patch Bay

A tangle of cables is one of the growing vexations of any audio system. With all of the inputs and outputs plugged into the rear panel, jumper cables plugged into the front make any hookup you need neatly.

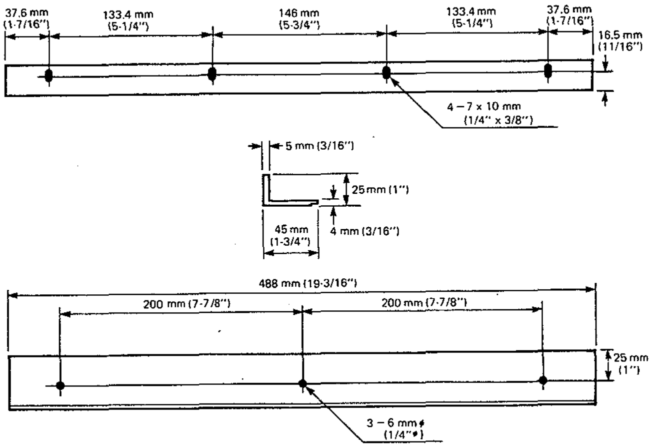



482 mm (19")
465 mm (18-5/16")
354 mm (13-15/16")
76.2 mm (3-1/16")
88 mm (3-7/16)
47 mm (1-7/8")
32mm (1-1/4")
26 mm (1")


290 mm (11-7/16")

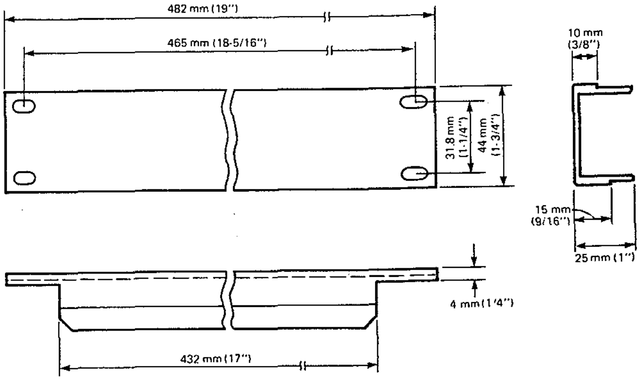
RM-500 Rack Mount Angle Kit (EIA 19-inch)

The RM-500 is a rack mount angle kit for the TASCAM 58 recorder/reproducer to enable mounting in the CS-607, or equivalent EIA standard 19-inch rack.


37.6 mm (1-7/16")
133.4 mm (5-1/4")
146 mm (5-3/4")
133.4 mm (5-1/4")
37.6 mm (1-7/16")
16.5 mm (11/16")
4 – 7 x 10 mm (1/4" x 3/8")
5 mm (3/16")
25mm (1")
45 mm (1-3/4")
4 mm (3/16")
488 mm (19-3/16")
200 mm (7-7/8")
200 mm (7-7/8")
25 mm (1")
3 – 6 mmϕ (1/4"ϕ)

T-0804 Blank Panel (EIA 19-inch)

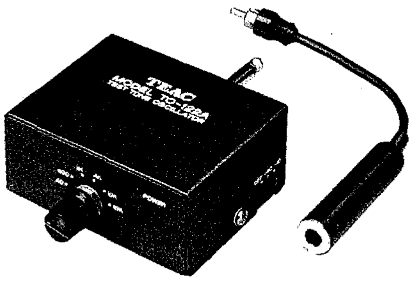
The T-0804 is designed to cover up the unavoidable blank spaces on the TASCAM CS-607, or equivalent EIA standard 19-inch rack.


482 mm (19")
465 mm (18-5/16")
31.8 mm (1-1/4")
44 mm (1-3/4")
10 mm (3/8")
15 mm (9/16")
25 mm (1")
4 mm (1'4")
432 mm (17")

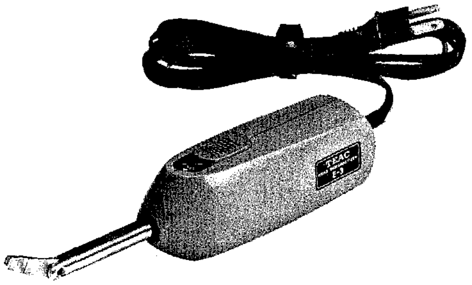
TO-122A Test Tone Oscillator

Checks input/output balance or other electric characteristics of the system chain. This unit is also useful for tape deck maintenance work.

*Output pin jack
*Output level -10 dB, -40 dB (0 dB/1 V)
*Selectable frequencies 40 Hz, 400 Hz,
1 kHz, 4 kHz, 10 kHz,
15 kHz



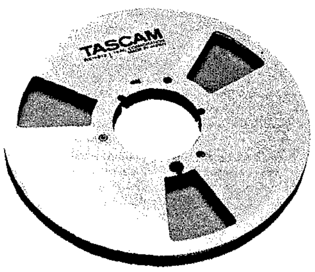
E-3 Head Demagnetizer



E-2A Bulk Eraser

TEAC
E-2A Bulk Eraser
POWER
ON

RE-1013 Metal Reel (10-1/2", 1/2" tape)



Professional Low Loss Cable

There are vast differences in cable design and performance, and those differences can make or break an otherwise excellent sound system. When you're investing in the kind of high quality audio equipment represented by the TASCAM Studio Series, it makes sense to use TASCAM professional audio cables. Anyone who's switched to them will tell you they're worth every cent.

LOW CAPACITANCE

Our cables feature very low capacitance under 15 picofarads per foot, so they don't act as high-frequency roll-off filters as do typical cables of 100 or 300 pF/foot. In addition, our cables use an ultra-high density bare-copper braided shield (99 % coverage), so electrostatic noise (buzz or hum) and RFI (CB or broadcast signals) are kept out of your program.

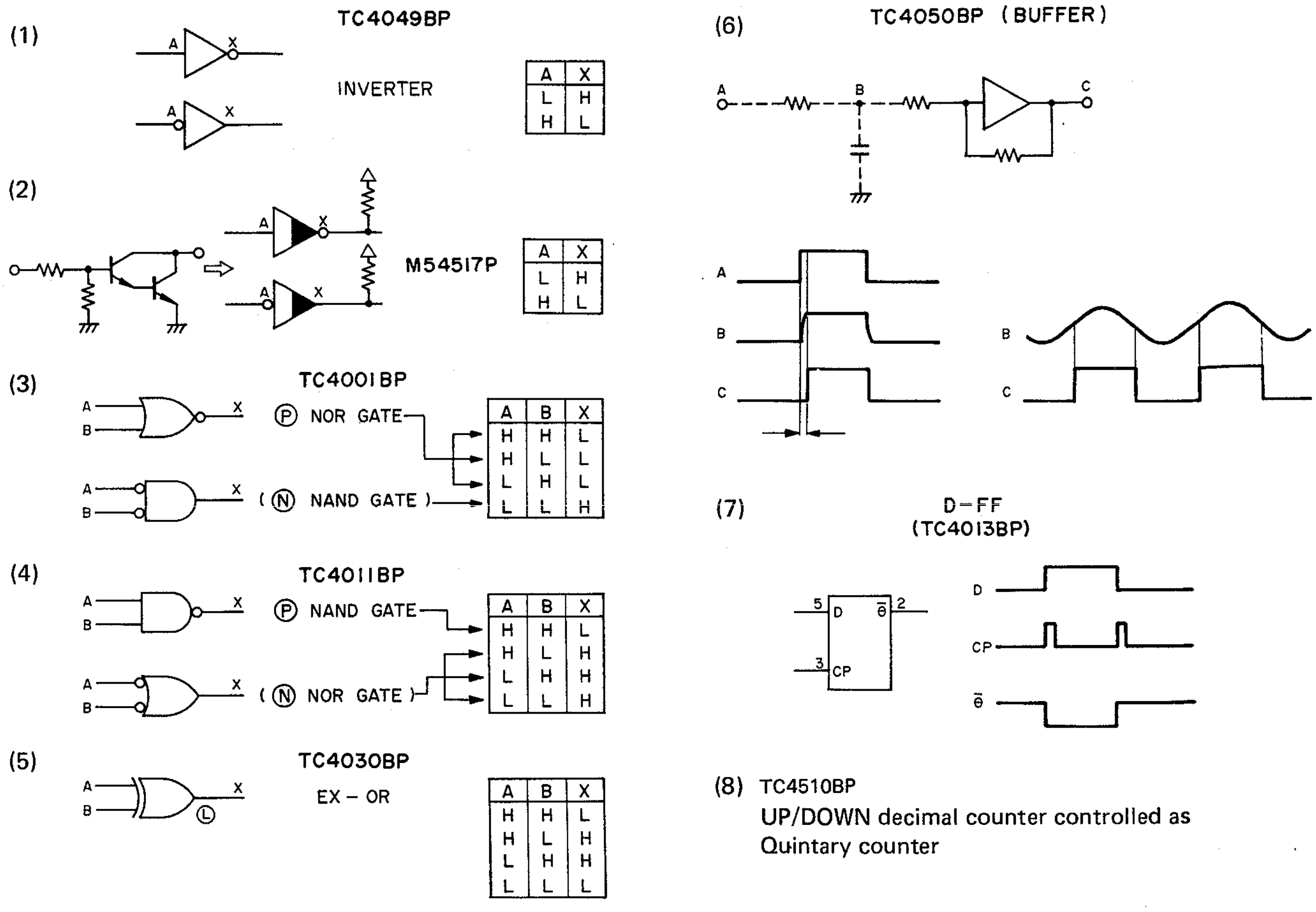
Low capacitance is important, and so is consistent capacitance; that is, you want the electrical coupling of center conductor-to-shield to remain the same throughout the cable, even if it is sharply bent, crushed, flexed, or tugged. Should the local cable capacitance change, noise and/or signal losses often result. We utilize the unique dielectric known as Datalene. This special insulation keeps the stranded signal conductor perfectly centered within the shield. Datalene is about as flexible as foam core dielectrics but far more resistant to extreme heat or cold, and it has a "memory", so it retains its shape after flexing. Datalene also acts as a mechanical shock absorber, guarding against external impacts which, in other cables, might sever the center conductors and cause intermittent contact.

When we join the connector to the cable, we insert the cable's stranded center conductor all the way into the pin and then fill the pin with solder. The braid is wrapped and soldered a full 120° around the shell, not tacked at one spot, so you get maximum shielding and strength.

5. THEORY OF OPERATION

5-1. LOGIC SYMBOLS

The logic operation elements used in this unit and their definitions are as follows:



(1) TC4049BP INVERTER

A	X
L	H
H	L

(2) M54517P

A	X
L	H
H	L

(3) TC4001BP Ⓟ NOR GATE (Ⓝ NAND GATE)

A	B	X
H	H	L
H	L	L
L	H	L
L	L	H

(4) TC4011BP Ⓟ NAND GATE (Ⓝ NOR GATE)

A	B	X
H	H	L
H	L	H
L	H	H
L	L	H

(5) TC4030BP EX – OR

A	B	X
H	H	L
H	L	H
L	H	H
L	L	L

(8) TC4510BP
UP/DOWN decimal counter controlled as Quintary counter

Fig. 5-1. Logic Symbol Chart

5-2. SENSOR CIRCUIT

A microcomputer is used to properly control all operating conditions such as running status of tape, direction of tape travel, etc. Running speed, tape direction, tape tension, stop condition, etc. are detected and input to the microcomputer, and for this reason, there are five photo-interruptor sensors employed in the unit.

5-2-1. Tape End Sensor Circuit

The end sensor circuit is comprized of a photo interruptor unit which consists of an LED, a photo transistor and a movable light shield plate placed between the LED and photo transistor, the switching transistor Q18 and the wave shaping circuit U13 (9, 10). The light shield plate, mounted on the tape tension arm post, is placed between the LED and the photo transistor so that it blocks the light from the LED when the tape is completely wound or when the tension arm drops backwards due to tape slack. This causes the photo transistor to cut off, causing the output of U13 to go H. Furthermore, when the REMOTE switch is turned on or off during the record, record pause modes, a STOP L level signal is applied to the base of Q18, cutting it off. This also causes pin 10 of U13 to develop an H level signal, which is used as a signal to stop the tape transport when erroneous operating conditions occur.

5-2-2. Tension Sensors (L & R)

Two separate sensors are provided for the left and right reels, and since their functions are identical, this description will be made to describe the operation of the left sensor only. The operation theory is the same as that of the end sensor except that the structure of the light shield plate is different. The edge of the plate is eccentrically curved so that the amount of light blocked by the plate varies proportionally to the amount of tape tension or variations of tape tension.

Consequently, internal resistance between the emitter and collector of the photo transistor varies proportionally to the angle of the moved tension arm. That is, voltage which is proportional to the amount of tape slack is developed at TP-1. The voltage output is led to a comparator in the motor control circuit and compared with a reference voltage specified by the operation mode. The resultant output, precisely controls the motor torque so that the tape tension is maintained within a specified range. The output voltage of TP-1 has been adjusted to approx. 5 V during the edit and play modes of operation, depending upon the tape tension variations for normal operation. Refer to Fig. 5-3 below and Fig. 7-17 on page 7-12.

A switching transistor Q1 connected in parallel with the sensor output is provided to disable the sensor as required. This operation will be described later on.

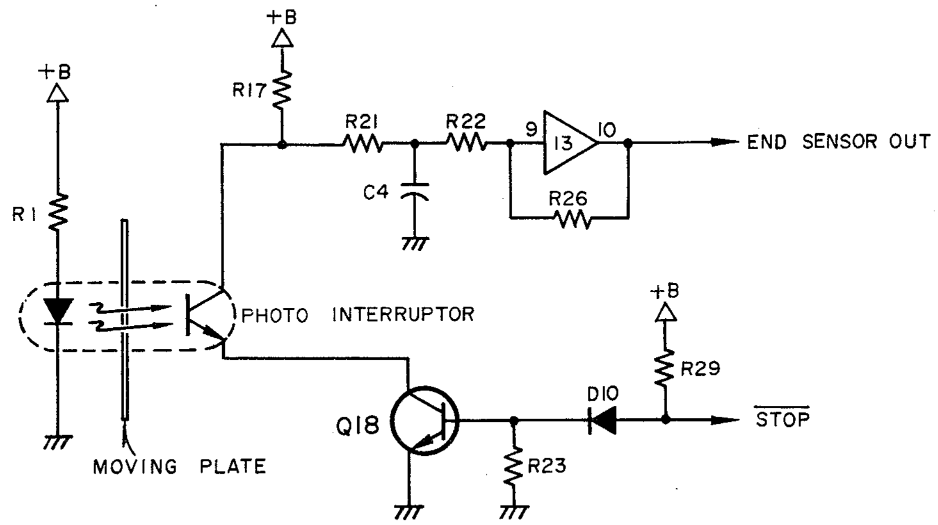

+B
+B
R17
R21
R22
9
13
10
END SENSOR OUT
C4
R26
R1
PHOTO INTERRUPTOR
+B
R29
D10
Q18
STOP
MOVING PLATE
R23

Fig. 5-2. Tape End Sensor Circuit

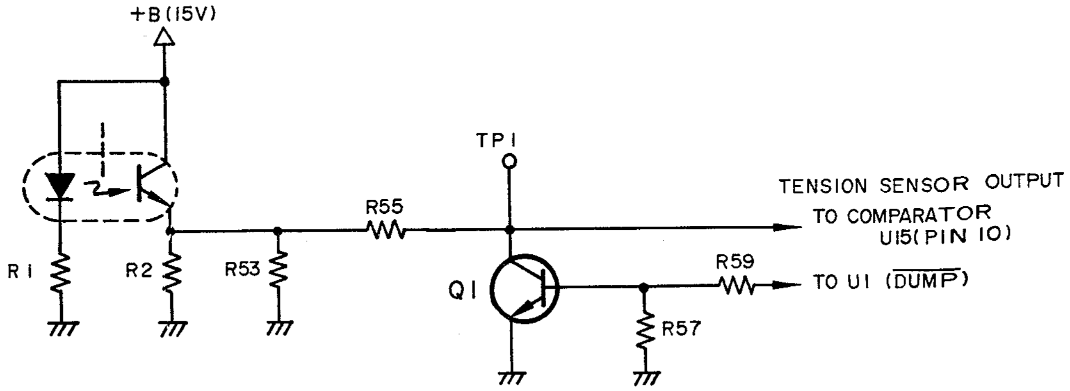

+B (15V)
TP1
TENSION SENSOR OUTPUT
R55
TO COMPARATOR U15(PIN 10)
R1
R2
R53
R59
Q1
TO U1 (DUMP)
R57

Fig. 5-3. Tension Sensors (L & R) Circuit

5-2-3. Speed Sensor Circuit

The sensor circuit detects both tape speed and transport directions of the tape. For these purposes, two photo interruptors are provided and each interruptor is positioned so that its pulse output has a 90° phase difference (Refer to Fig. 5-5, "External Counter Timing Chart", TP-4 and TP-5.). The pulse developed at TP-4 and TP-5 is proportional to the running speed of the tape and is respectively applied to pins 3 and 5 as a rotational pulse after waveshaping. As the result, an L level output is developed at (PLAY, FF) pin 2 output of flip-flop U6 when the tape is running in the forward direction, and an H level output is developed when the tape is running in the reverse direction. These signals are used so that the microcomputer is able to determine tape running conditions. U5, which is connected to the latter stage of U6, is a 1/5 divider provided to allow count-down of the rotational pulse frequency to match the computer's processing ability. The output divided by one-fifth is obtained from D OUT during forward operation, and from output of the AND circuit (D11, D12, D13) during the reverse operation. The signal is then sent to the $\overline{\text{IRQ}}$ terminal (pin 4) of the microcomputer through the NOR gate U4, and is used to indicate the running time of the tape.

When the power is turned on, a positive pulse is generated from the SO terminal of the microcomputer and this turns the input to pin 9 of U5 positive. Then, the 1/5 divider is cleared and the external counter is reset.

Since the rotational pulse frequency output from the EX-OR gate (pin 11 of U12) is proportional to the running tape speed as mentioned previously, the pulse output is also used to control the motors. This operation will also be described later on.

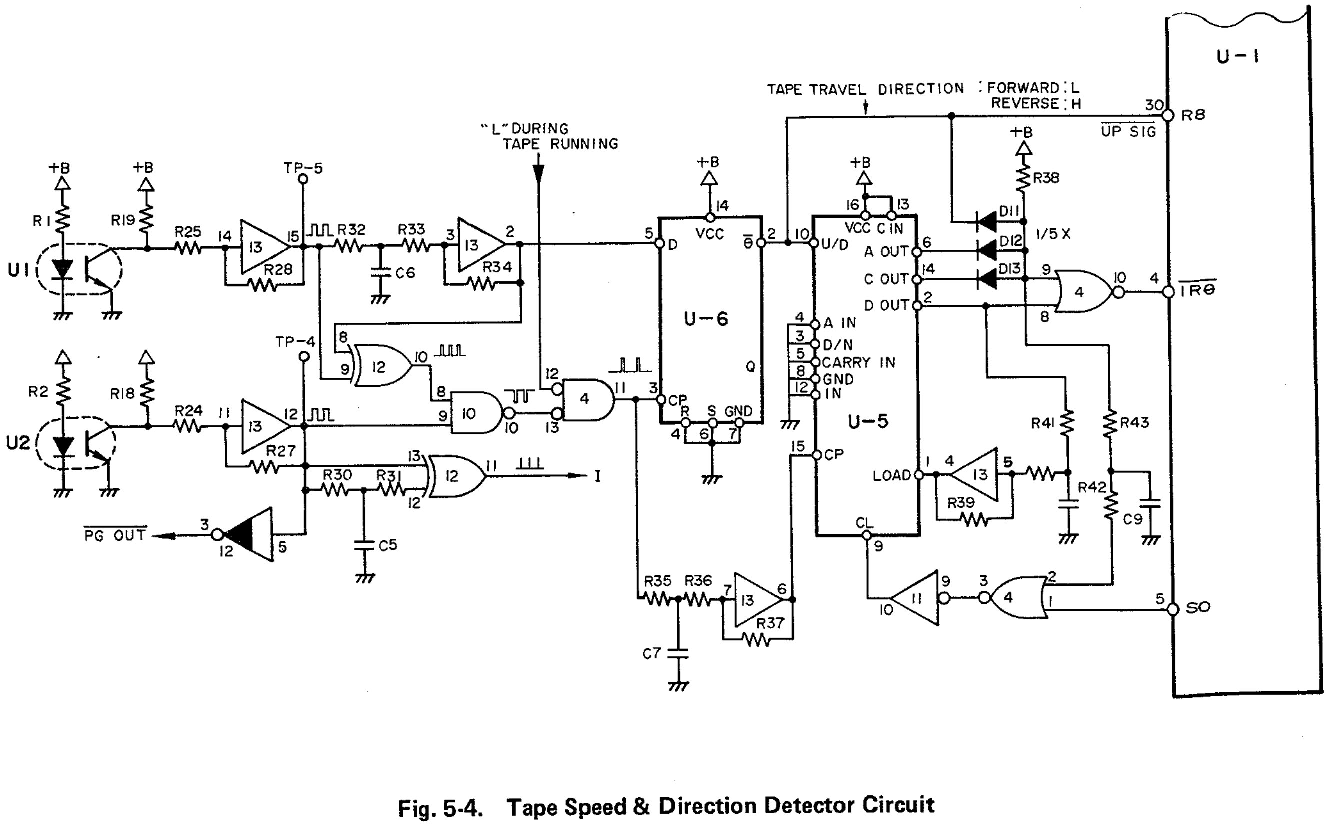

U-1
TAPE TRAVEL DIRECTION : FORWARD : L
REVERSE : H
"L" DURING TAPE RUNNING
+B
R1
R19
R25
R32
R33
R28
R34
C6
TP-5
TP-4
U1
U2
R2
R18
R24
R27
R30
R31
C5
PG OUT
U-6
D
VCC
Q̄
Q
CP
R
S
GND
U-5
VCC C IN
U/D
A OUT
C OUT
D OUT
A IN
D/N
CARRY IN
GND
IN
CP
LOAD
CL
R38
D11
D12
D13
1/5 X
UP SIG
R8
IRQ
SO
R41
R43
R42
C9
R39
R35
R36
R37
C7
I

Fig. 5-4. Tape Speed & Direction Detector Circuit

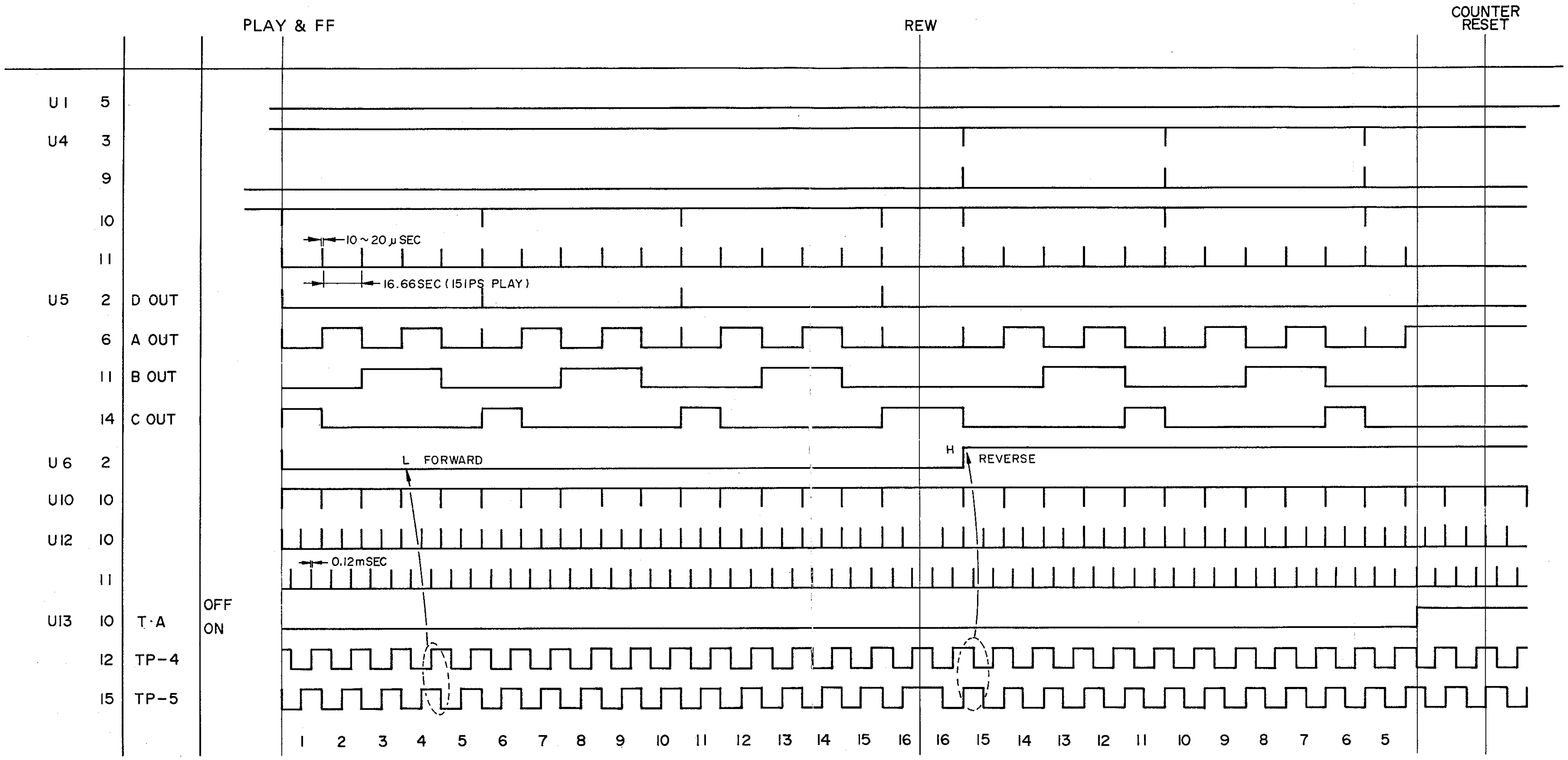


Fig. 5-5. External Counter Timing Chart

5-3. POWER ON/OFF RESET

To prevent erroneous operations of the microcomputer and any other circuits due to transient voltage variations of power lines when power is turned on or off, a power on/off reset circuit (Fig. 5-6) is provided so that the microcomputer will be automatically reset immediately after the power is turned on or off.

In operation, capacitor C1 is charged from the +5 V line first when the power is turned on, disenabling the reset terminal of U1 (pin 3) from going high and causing it to remain low until C1 is completely charged. That is, the microcomputer is automatically set to a specified condition and rejects further instructions until all circuits, including amplifiers have been stabilized for approx. 3 seconds, during which, the PAUSE LED blinks to show that the system is in the initially specified condition. After C1 is fully charged and the 3 second period has elapsed, the reset terminal goes H and the computer is now able to accept instructions.

When the power is turned off, the electric charge stored in C1 is rapidly discharged through the low resistance of D9 and R137, indicated by the arrow in the illustration. This turns the reset terminal of U1 to an L level before the power line voltage for the microcomputer decreases, thus causing the computer to return to the reset condition.

The diode D38 is provided to discharge the reset terminal when the power line voltage is reduced, caused by a possible short-circuit from an external circuit such as a remote control circuit, etc.

The diode D36 in Fig. 5-6 is also provided to make D9 cut off by applying a higher voltage to the cathode of D9 than that of its anode. The voltage is generated by rectifying the 6 V AC voltage.

D35 and U19 detect the power off condition, and automatically sets the unit to the power off mode when the power is interrupted because of power failure, etc. In the normal state, a pulse signal, generated by rectifying and wave-shaping the 6 V AC, is applied to pin 32 of U1. The pulse is periodically checked by the microcomputer, and if two successive pulses are not applied continuously, the microcomputer determines that the power has been turned off or interrupted and generates a stop signal.

Furthermore, when the power is turned on, the microcomputer generates an H level signal from its own pin 37 (STB) for approx. 3.3 sec. (Reset + 3 sec.) to shorten out the amplifier circuits, thus preventing transient noises, etc. that are caused in initial operation. This power muting function is also actuated if two pulses are not successively input when the power is turned off.

Refer to Fig. 5-7 for the Timing Chart.

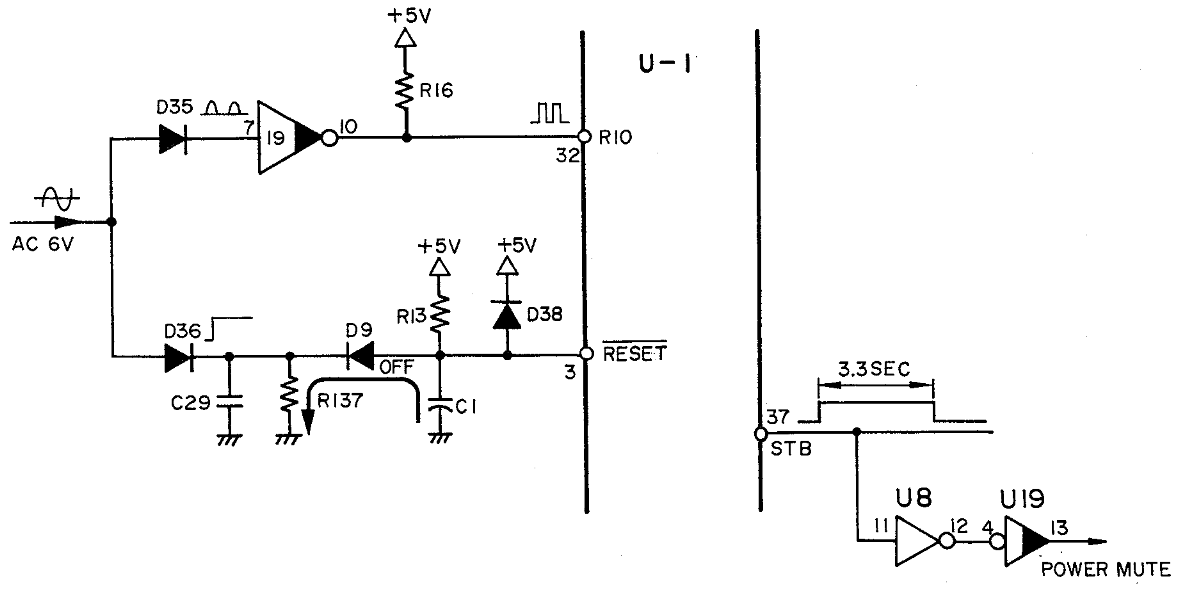


Fig. 5-6. Power On/Off Reset Circuit

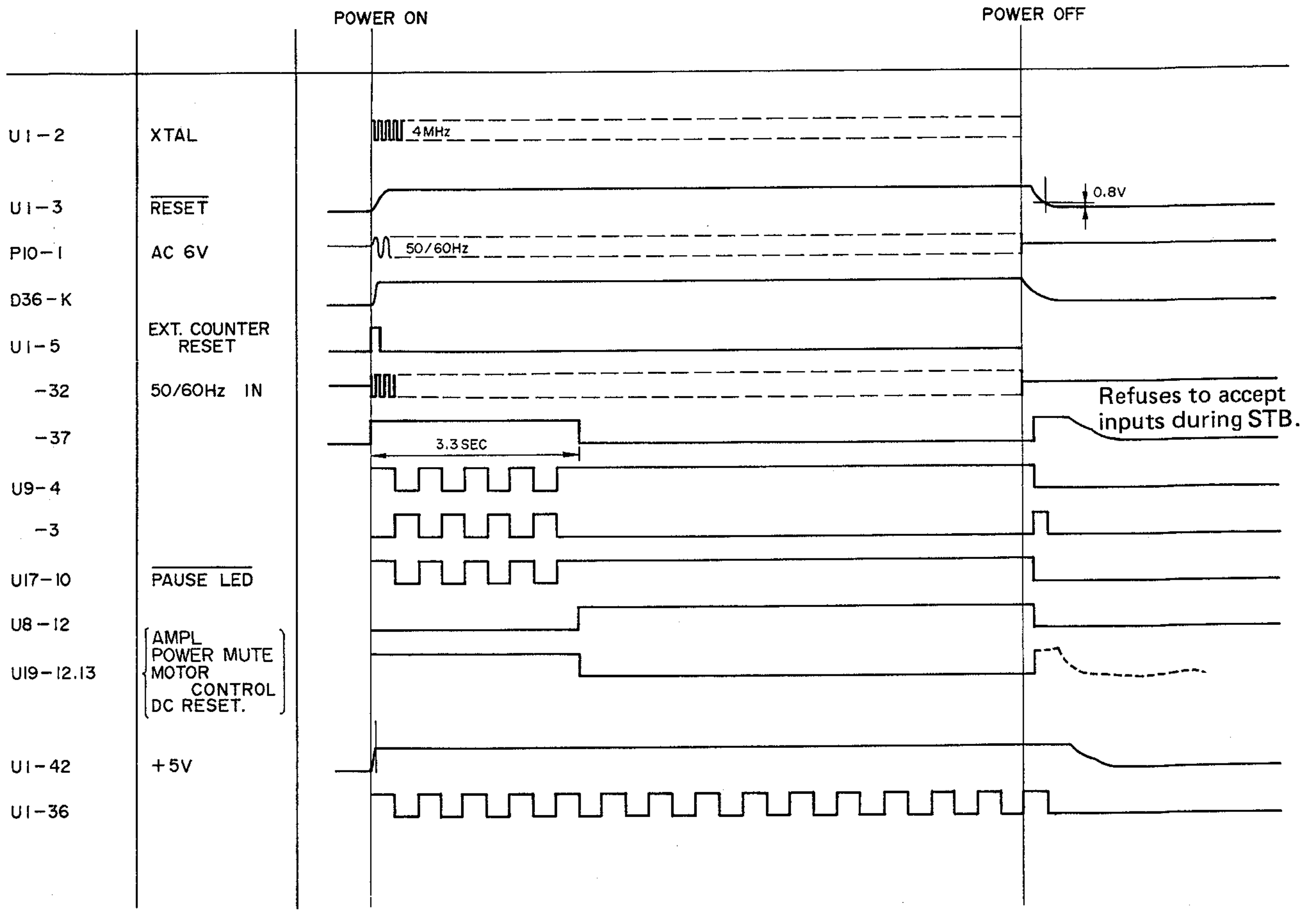


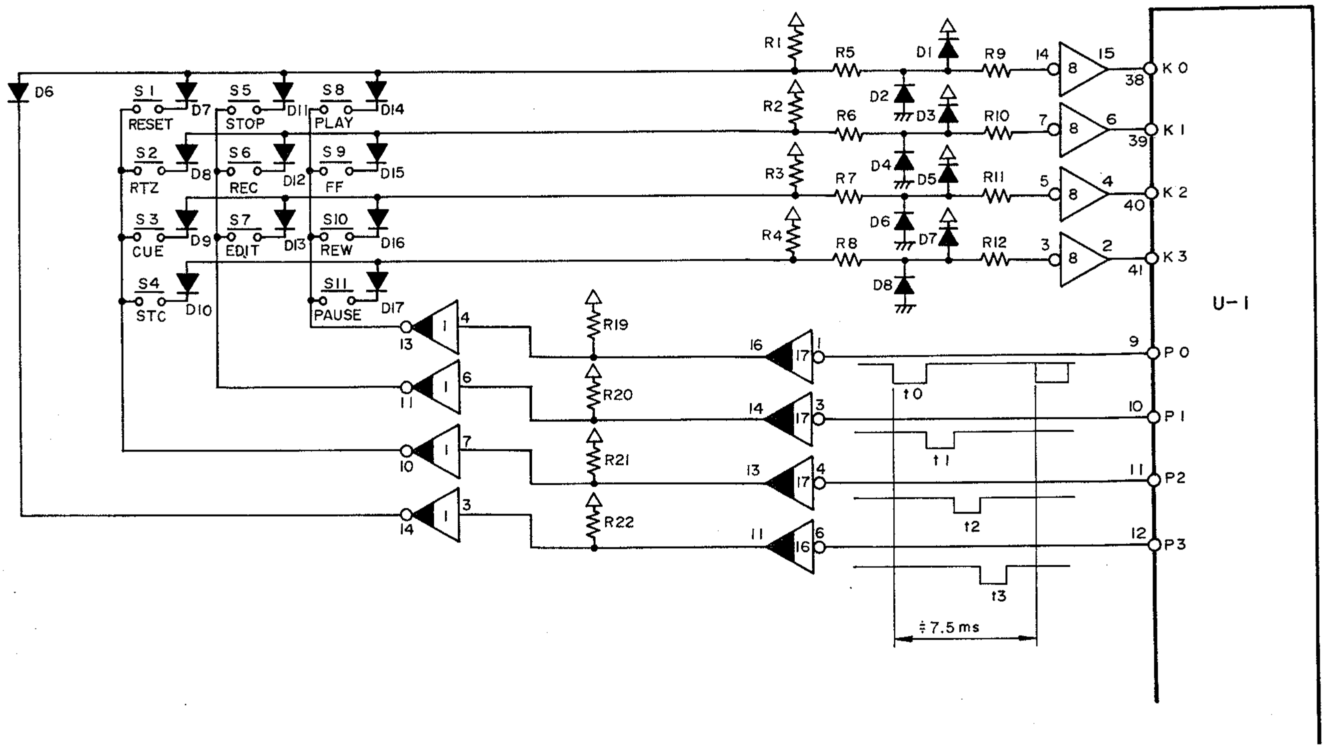
Fig. 5-7. Power On/Off Operations Timing Chart

5-4. ENTRY OF OPERATION INSTRUCTIONS

In this tape deck, all operation signals are first sent to the internal logic circuits of the computer and processed according to the programs predetermined to adjust operating time and periods timings, etc. After that, the computer outputs the resulting outputs as operating instruction signals. The next description will be made on how the computer interprets the instructions.

The microcomputer U1 always generates five phase scanning pulses (P0, P1, P2, P3, & P4) through its pin terminals 9, 10, 11, 12, and 31. Of these pulses, P0 through P3 are used to read instructions. Each of these scanning pulses are designed to be applied to one of the instruction input terminals (38 through 41 of U1) by the selection of one or more of the operating buttons such as play (▶), RECORD, PAUSE, etc. That is, the computer decodes its instructions by checking which of the scanning pulses (P0 – P3) have been input to which terminal (K0 – K3). For example, in Fig. 5-8, when the (▶) button is pushed at time 'to', pin 14 of U8 goes L, causing K0 to go H. In other words, the computer determines that the play operation has been conducted because its own K0 terminal is set to H at time 'to'. Next, when the (▶) and REC function buttons are pressed, K0 goes H at 'to' as mentioned above, and K1 also goes H at 't1'. Now, the computer understands that an operation for recording has been made, and all signals required for recording such as reel motor drive signals, record-reproduce switching signals, record indicator signal, etc. are generated. Sixteen instructions are possible since four scanning pulses and four instruction input terminals are used. However, in an actual unit, the instructions corresponding to the simultaneous depressing of two buttons or the depressing of a single button twice in succession, etc. are also programmed inside the computer U1; the actual instructions available are more than 16, and this makes the deck very easy to use.

In this way, most of the signals required to execute these various instructions are processed within the computer, resulting in the simplifying of external circuits. Thus, increasing reliability and making maintenance, troubleshooting, etc. easier to perform.



D6
S1
D7
RESET
S5
D11
STOP
S8
D14
PLAY
S2
D8
RTZ
S6
REC
D12
S9
FF
D15
S3
D9
CUE
S7
EDIT
D13
S10
REW
D16
S4
STC
D10
S11
PAUSE
D17
R1
R2
R3
R4
R5
R6
R7
R8
D1
D2
D3
D4
D5
D6
D7
D8
R9
R10
R11
R12
14
15
38
K0
7
6
39
K1
5
4
40
K2
3
2
41
K3
U-1
R19
R20
R21
R22
16
17
9
P0
14
3
10
P1
13
4
11
P2
11
16
6
12
P3
t0
t1
t2
t3
≑7.5 ms

Fig. 5-8. Instruction Read-in Circuit

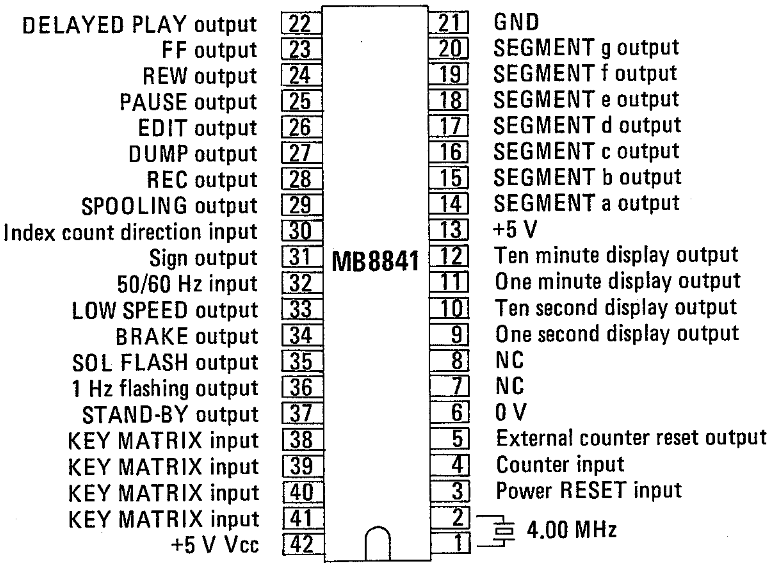

DELAYED PLAY output 22
FF output 23
REW output 24
PAUSE output 25
EDIT output 26
DUMP output 27
REC output 28
SPOOLING output 29
Index count direction input 30
Sign output 31
50/60 Hz input 32
LOW SPEED output 33
BRAKE output 34
SOL FLASH output 35
1 Hz flashing output 36
STAND-BY output 37
KEY MATRIX input 38
KEY MATRIX input 39
KEY MATRIX input 40
KEY MATRIX input 41
+5 V Vcc 42
MB8841
21 GND
20 SEGMENT g output
19 SEGMENT f output
18 SEGMENT e output
17 SEGMENT d output
16 SEGMENT c output
15 SEGMENT b output
14 SEGMENT a output
13 +5 V
12 Ten minute display output
11 One minute display output
10 Ten second display output
9 One second display output
8 NC
7 NC
6 0 V
5 External counter reset output
4 Counter input
3 Power RESET input
2
1
4.00 MHz

Fig. 5-9. U1 (MB8841) Pin Assignment and Function

5-5. TAPE TRANSPORT CONTROL CIRCUIT

This section provides information on the various tape transport modes and their associated circuits, including indicator circuits.

Refer to the section of the timing chart that corresponds to the mode in description. The small alphabetic letters at the beginning of each description are represented encircled in the timing chart. The encircled letters also indicate the timing sequence in the chart.

5-5-1. Reproduce Mode

When the play (▶) button is pressed, the microcomputer detects the play instruction as previously mentioned and the following signals develop.

a. Pin 34 ($\overline{\text{BRAKE}}$) goes L; Q11 turns off and its collector voltage is increased. This makes Q15 conductive, connecting the ground circuit of the brake solenoid. That is, the brake solenoid becomes energized and the brakes are released. Pin 15 of U19 goes from H to L, and this also releases the muting circuit in the playback circuit.
Transistor Q7 is also turned on; Q1 goes off and left tension sensor output is applied to pin 10 of U15 – the comparator circuit.

b. Since pin 27 of U1 is at an H level, pin 13 of U7 becomes L. Q2 is still in the off condition and now, right tension sensor output is applied to pin 5 of U15 – another comparator circuit.

c. Pin 22 (PLAY) of U1 goes L and Q12 turns on, followed by Q17 turning on which connects the ground side of the pinch roller solenoid to activate the pinch roller.
Because the collector of Q13 is now H, a differential pulse is applied to the base of Q9 through C20, making Q9 turn on for a time period determined by the time constant provided. As a result, the take-up motor drive circuit is actuated in the fast forward mode for a brief time period to supply flashing voltage required for starting the motor, as described later.

d. Pin 35 (FLASH) of U1 develops one negative pulse as shown in the timing chart. Then, Q10 and Q14 are turned on. Since Q14 collector voltage is applied to the base of Q8 of the power supply circuit, Q8 supplies a large flashing voltage to the plunger solenoids which operate in the play mode for approx. 0.3 sec. to assure stable starting operations.

e. In the play mode of operation, pin 23 ($\overline{\text{FF}}$) and pin 24 ($\overline{\text{REW}}$) of U1 are turned high, and pin 10 of U3 remains low. Pin 15 of U7 becomes H, and Q3 and Q4 are turned on accordingly. That is, the common junction point of R1, R2 and R3, R4 becomes grounded, and a reference voltage that's required for the comparator circuit of the left and right reel motor control circuits is determined. Namely, tension that's applied to each motor is determined. Furthermore, voltage proportional to the tension variations (approx. 5 V under normal operation) is applied from the left and right tension sensors to pin 10 and pin 5 of U15, respectively. Then, both comparators control the respective motors so that the tape is driven at the specified tension.

f. The second stage circuit of the motor control circuit, or the circuit that includes U15 – the operational amplifier (12, 13, 14), and Q5 and Q21 that make up the constant current control circuit operates to ensure that a constant current is always supplied to the motor by applying the feed back voltage developed across resistor R1 to pin 13 of U15.

5-5-2. Fast Forward Mode

a. When the fast forward (▶▶) button is pressed, pin 35 ($\overline{\text{FLASH}}$) of U1 goes L and a flashing current flows into the plunger solenoids as mentioned in the reproduce mode.

b. Pin 23 ($\overline{\text{FF}}$) of U1 goes L and this causes pin 10 of U3 to develop an H level to make pin 15 of U7 go L. As the result, transistors Q3 and Q4, which determine the reference voltage for the comparators, are turned off and R1, R2 and R3, R4 are respectively connected in series to provide a reference voltage for the fast forward mode of operation.
With pin 23 ($\overline{\text{FF}}$) L, contacts 1 and 2 of the analog switch U14 are closed because output pin 11 of U7 is sent H, and the control voltage described in the following section is applied to the non-inverting input terminal of the comparator U15 in the take-up motor control circuit.

c. Rotational Pulse Control
As mentioned in 5-2-3, "Speed Sensor Circuit", pin 11 of U12 (EX-OR) always develops rotational pulses, the frequency of which, is proportional to the tape transport speed. (Refer to Fig. 5-10, Waveform Ⓐ.) Since pins 29 and 33 of U1 are H, pin 11 of U2 goes L, and U14 contacts 10 and 11 are closed. Capacitor C21 is charged from a +15 V line through R115, R116 and R113, R114 – a parallel network. The rotational pulses, however, owing to having a frequency proportional to the tape speed, are applied to C21 through resistor R117 as shown in Fig. 5-10, waveform Ⓑ. The charged voltage across C21 turns high as the tape speed decreases or low as the tape speed increases. The charging and discharging voltages across C21 are rectified and filtered by C22 and R118. Thus, the voltage developed is applied to the operational amplifier through the analog switch U14 (1 – 2), just described to control the takeup reel motor so that the tape speed is alway constant regardless of the amount of tape wound on the tape reels. The reference voltage for back tension, or at TP-1 is approx. 7.4 ~ 8 V during the fast forward mode of operation. Another reference voltage obtained by rectifying the rotational pulses at R118 (hot side) is approx. 1.2 ~ 1.25 V under stabilized tape running condition.

d. During the forward spooling mode, pin 29 ($\overline{\text{SPOOL}}$) of U1 goes L. Then, terminals 8 and 9 of the analog switch U14 close and R111, R112 and R115, R116 are connected in parallel. The time constant for the rotational pulse control voltage generating circuit is then decreased to within a specified value for the spooling mode.

e. The L output from pin 29 is also applied to pin 6 of U17 through output pin 15 of U17, causing the SPOOLING indicator LED to light.

f. During the fast forward mode, pin 10 of U3 is H and pin 11 of U3 is L, causing Q12 to turn on, followed by Q16 also turning on. At this time, the lifter solenoid is activated and the tape is lifted from the head surface to prevent abrasion.

g. The operation of the spooling mode is programmed to be performed by the pressing of the (▶▶) button twice in succession.

h. For details regarding the motor control circuit, refer to the Fig. 5-12, "Motor Control Timing Chart".

5-5-3. Rewind Mode

a. When the rewind (◀◀) button is pressed, pin 24 ($\overline{\text{REW}}$) of U1 goes L. Then pin 10 of U3 goes H, and Q3 and Q4 also go on the same as in the fast forward mode. With this, the reference voltage for fast winding is set.

b. With the $\overline{\text{REW}}$ output turned L, terminals 3 and 4 of the analog switch U14 are each closed. The rotational control voltage described in 5-5-2, "Fast Forward Mode" is applied to pin 12 of U15 in the supply reel motor control circuit to control the motor so that constant tape speed is maintained irregardless of the amount of tape on the reel.

c. The operation of the spooling mode in the rewind mode is the same as that in the fast forward mode, except for rotational direction of the motors.

5-5-4. From Rewind to Play Mode

a. When the play (▶) button is pressed during the rewind mode of operation, pin 23 of U1 goes L first, and the tape deck is temporarily set to the fast forward mode to apply electromagnetic braking to the supply reel motor. When the tape speed is decreased to 40 ips (100 cm/sec.), the electromagnetic brake is automatically released and the mechanical brake is activated to make the motor stop.

b. Approx. 0.5 sec. after the mechanical brake is activated, or upon a play instruction, the microcomputer U1 develops an L level signal at its own pin 22. The tape deck will now operate in the play mode as described in 5-5-1.

5-5-5. Pause Mode

a. When the PAUSE button is pressed, pin 25 of U1 goes L, and as a result, pin 15 of U19 goes L and the play mute operation is released.

b. Pin 34 ($\overline{\text{BRAKE}}$) goes H, and brakes are applied to both reel tables.

c. With pin 25 of U1 turned L, pin 3 of U9 goes H, causing pin 10 of U17 to go L. This in turn, causes the PAUSE LED (D4) to light.

5-5-6. Edit Mode (Manual)

a. When the EDIT button is pressed, pin 26 of the microcomputer U1 goes L, causing pin 4 of U2 to go high, followed by pin 16 of U18 going L to turn the EDIT indicator LED on.

b. Pin 34 ($\overline{\text{BRAKE}}$) of U1 also goes L, releasing the mechanical brakes from the reels which allows the reels to be manually rotated.

c. During the edit mode of operation, all mechanical operations are in the play mode of operation, except for the pinch roller being disabled.

5-5-7. Edit Play Mode (Dump)

a. In this mode of operation, pin 27 of U1 goes L, and pin 4 of U2 goes H to turn the EDIT indicator LED on.

b. Pin 4 of U7 also goes L and Q2 is turned on because of its base potential increasing to a high level. With Q2 on, pin 5 of U15 – the comparator of the right reel motor control circuit, is grounded causing the right reel motor to stop. However, as pin 22 of U1 is being maintained at an L level, the pinch roller is activated, so the tape threaded can be fed during the play mode.
(This circuit functions if the END sensor is actuated – output goes H.)

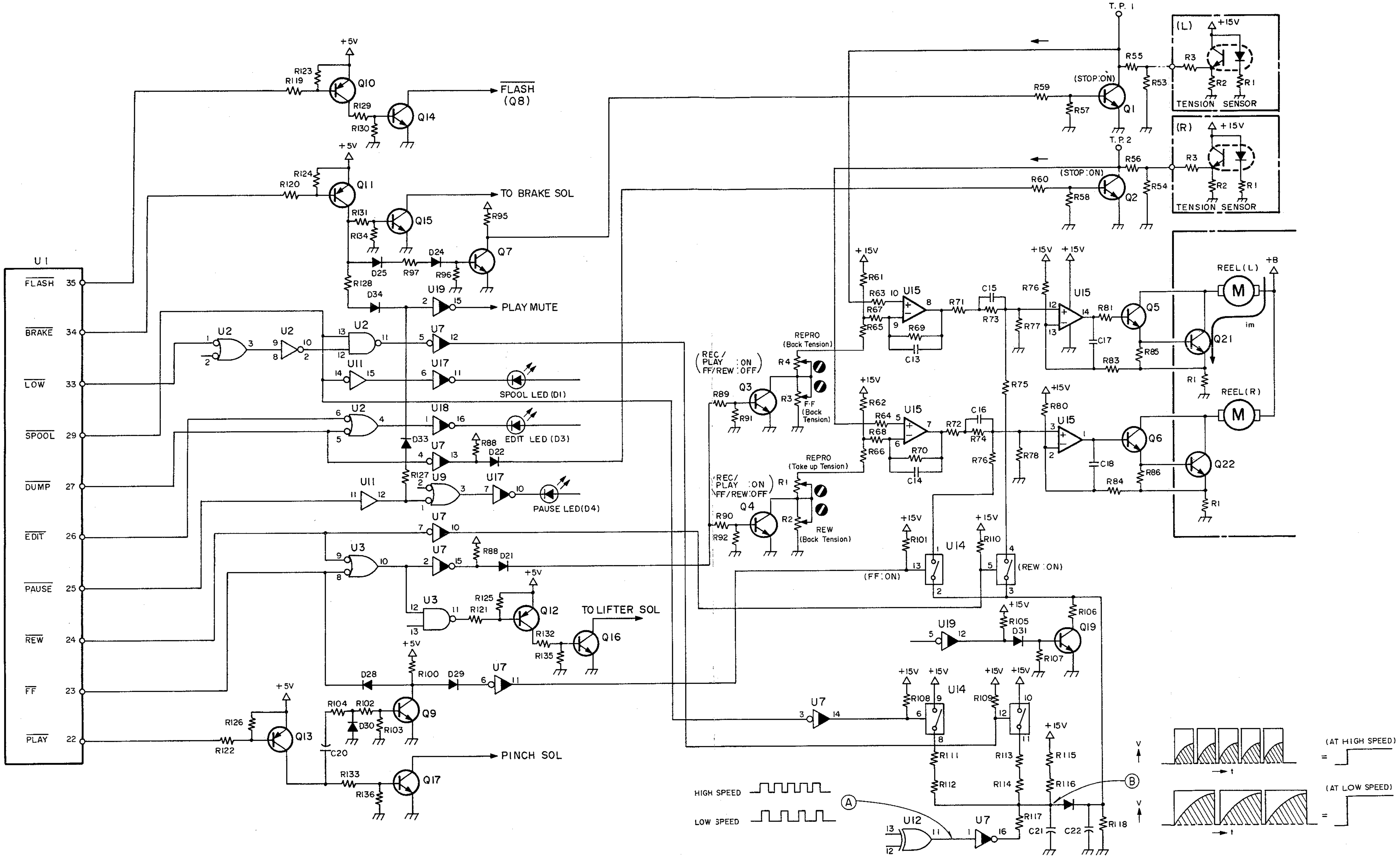
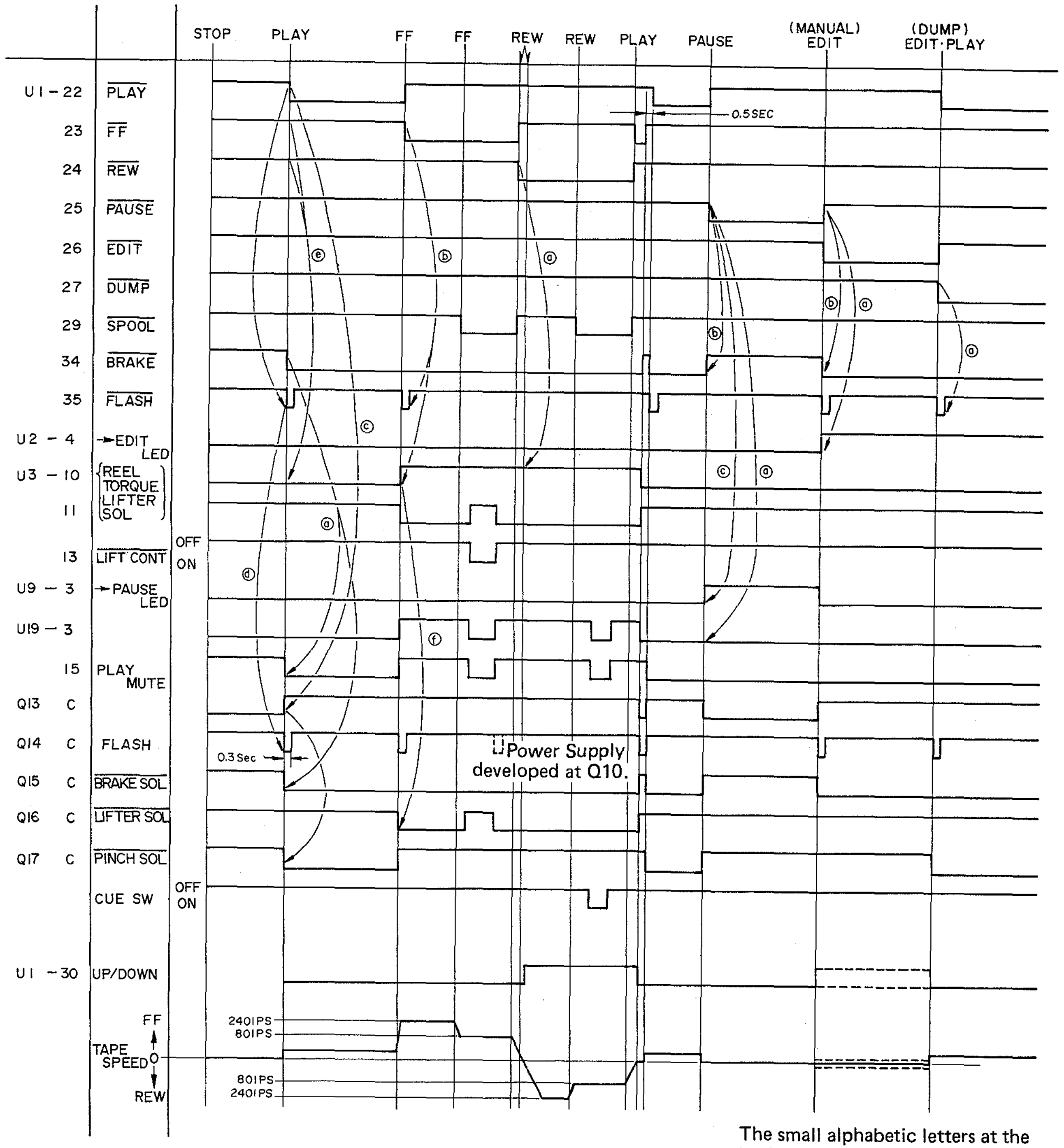
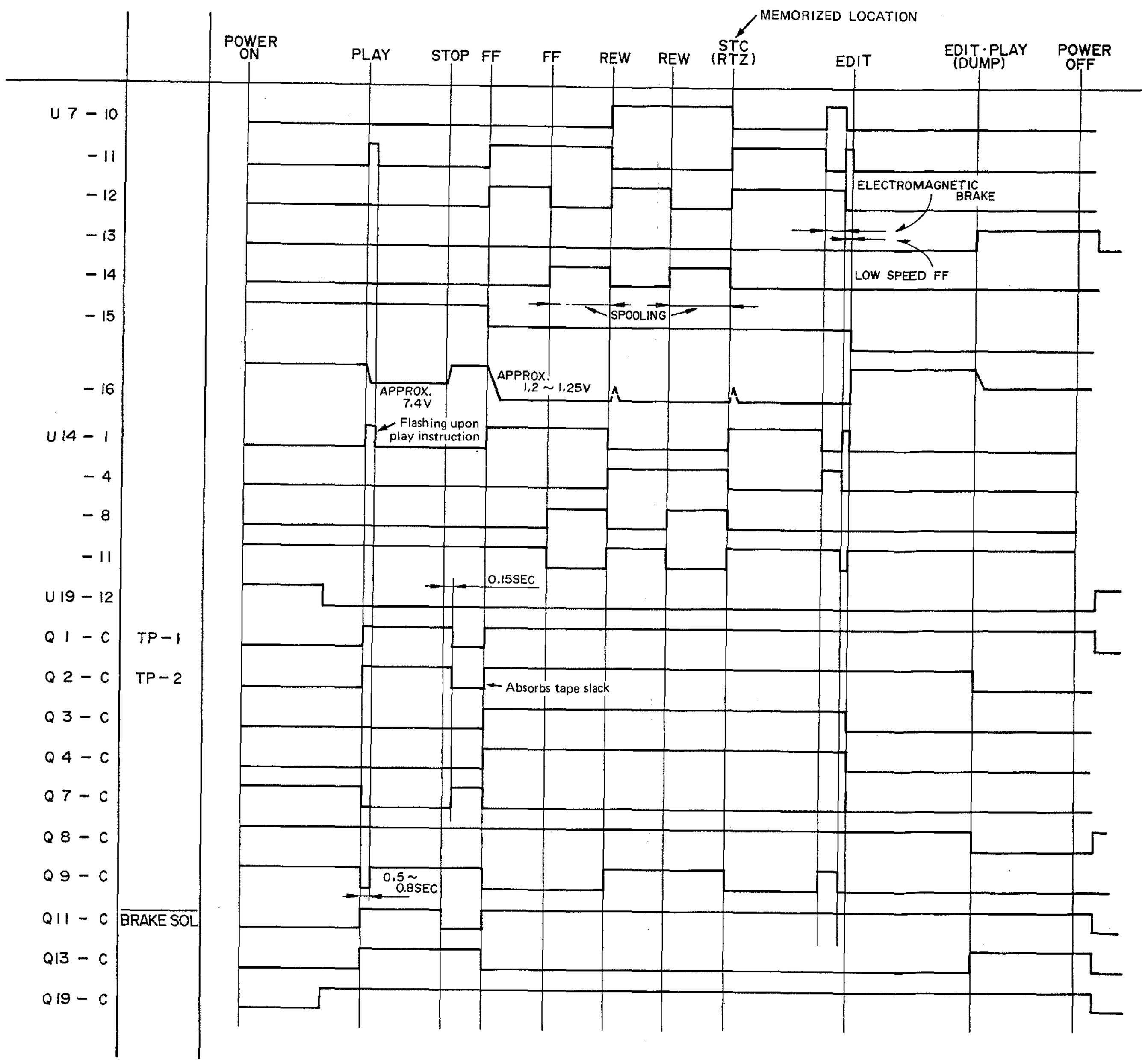

U1
FLASH 35
BRAKE 34
LOW 33
SPOOL 29
DUMP 27
EDIT 26
PAUSE 25
REW 24
FF 23
PLAY 22
FLASH (Q8)
TO BRAKE SOL
PLAY MUTE
SPOOL LED (D1)
EDIT LED (D3)
PAUSE LED (D4)
TO LIFTER SOL
PINCH SOL
T. P. 1
T. P. 2
(STOP:ON)
(L)
(R)
TENSION SENSOR
REEL (L)
REEL (R)
REPRO (Back Tension)
REPRO (Take up Tension)
REC/PLAY :ON FF/REW :OFF
F·F (Back Tension)
REW (Back Tension)
(FF:ON)
(REW:ON)
HIGH SPEED
LOW SPEED
(AT HIGH SPEED)
(AT LOW SPEED)

Fig. 5-10. Reel Motor Control Circuit


STOP
PLAY
FF
FF
REW
REW
PLAY
PAUSE
(MANUAL) EDIT
(DUMP) EDIT·PLAY
U1 - 22 PLAY
23 FF
24 REW
25 PAUSE
26 EDIT
27 DUMP
29 SPOOL
34 BRAKE
35 FLASH
U2 - 4 →EDIT LED
U3 - 10 REEL TORQUE LIFTER SOL
11
13 LIFT CONT
U9 - 3 →PAUSE LED
U19 - 3
15 PLAY MUTE
Q13 C
Q14 C FLASH
Q15 C BRAKE SOL
Q16 C LIFTER SOL
Q17 C PINCH SOL
CUE SW
OFF
ON
U1 - 30 UP/DOWN
FF
TAPE SPEED
0
REW
240IPS
80IPS
80IPS
240IPS
0.5SEC
0.3Sec
Power Supply developed at Q10.
ⓐ
ⓑ
ⓒ
ⓓ
ⓔ
ⓕ

The small alphabetic letters at the beginning of each description are represented encircled in the timing chart. The encircled letters also indicate the timing sequence in the chart.

Fig. 5-11. Control Circuit Timing Chart


MEMORIZED LOCATION
POWER ON
PLAY
STOP
FF
FF
REW
REW
STC (RTZ)
EDIT
EDIT·PLAY (DUMP)
POWER OFF
U7 - 10
- 11
- 12
- 13
- 14
- 15
- 16
U14 - 1
- 4
- 8
- 11
U19 - 12
Q1 - C TP-1
Q2 - C TP-2
Q3 - C
Q4 - C
Q7 - C
Q8 - C
Q9 - C
Q11 - C BRAKE SOL
Q13 - C
Q19 - C
ELECTROMAGNETIC BRAKE
LOW SPEED FF
SPOOLING
APPROX. 7.4V
APPROX. 1.2 ~ 1.25V
Flashing upon play instruction
0.15SEC
Absorbs tape slack
0.5 ~ 0.8SEC

Note: Only functions ON/OFF, except for U7-16.

Fig. 5-12. Motor Control Timing Chart

5-5-8. Record Mode

a. When the RECORD and PAUSE buttons are pressed for record level setting, each portion of the circuit operates as indicated in the "Timing Chart for Recording Operations" shown in Fig. 5-14. The PAUSE indicator LED lights and the RECORD indicator LED begins blinking when the REC function switch is placed in the OFF position. The RECORD indicator LED will remain on if pin 3 of U11 is H and if the REC function switch is in the ON position. (Refer to Fig. 5-13).
Pin 25 (PAUSE) of U1 goes L and the transport mechanism switches to the pause mode.

b. Next, when the play (▶) button is pressed to release the pause mode to enable recording, pin 3 of U9 goes L and the PAUSE LED is turned off.

c. Under this condition, the RECORD LED continues to blink off and on, indicating that recording can not be conducted. Next, when one of the eight REC function switches is pressed, designating a channel selection for recording, pin 14 (REC MODE Sig.) of U2, shown in the FUNCTION A PCB ASSY goes L, causing pin 3 of U11 shown in the CONTROL PCB ASSY below to increase to an H level. Then pin 3 of U10 goes L and pin 11 of U10 goes H, and at this point, the RECORD LED remains on instead of blinking. Furthermore, if one or more of the REC function switches are turned on, the REC READY Sig. terminal(s) corresponding to the channel(s) designated goes L and the designated record circuit(s) are actuated to enable recording operations. (Refer to 5-7-4, "Record Mode".)

d. When RECORD and play (▶) buttons are pressed together during recording, the recording mode changes to the punch-out mode. The punch-in mode can be changed to the punch-in mode by pressing these two buttons once again. These operations are controlled through the microcomputer and no external circuits are concerned. Therefore, if these operations are not executed as anticipated, the operation mode switches or the microcomputer may be suspected.

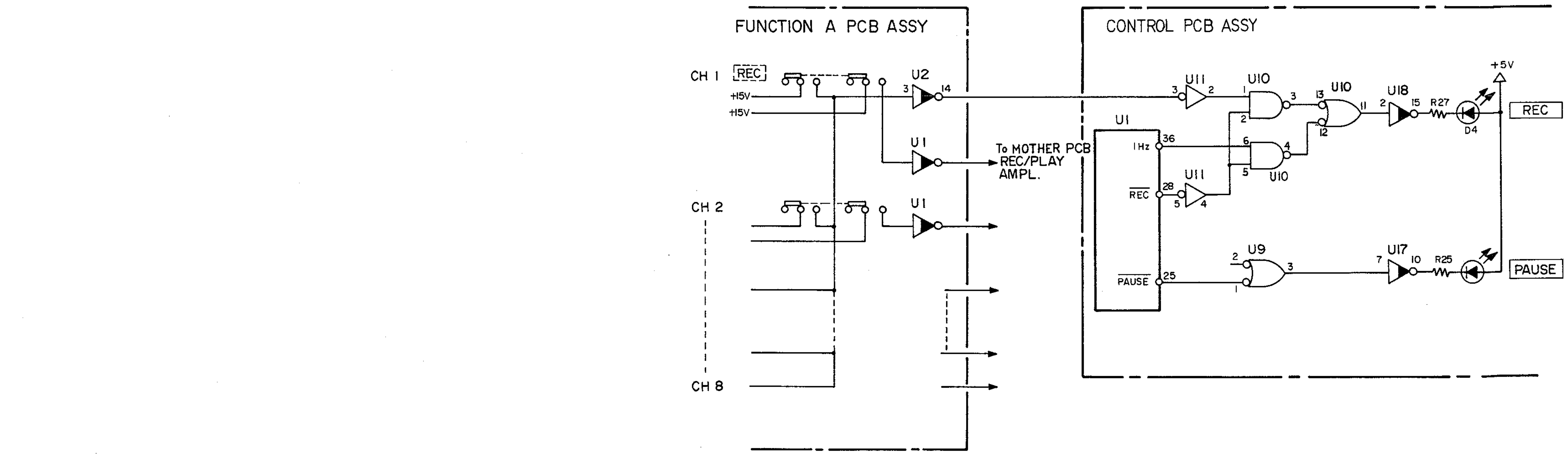
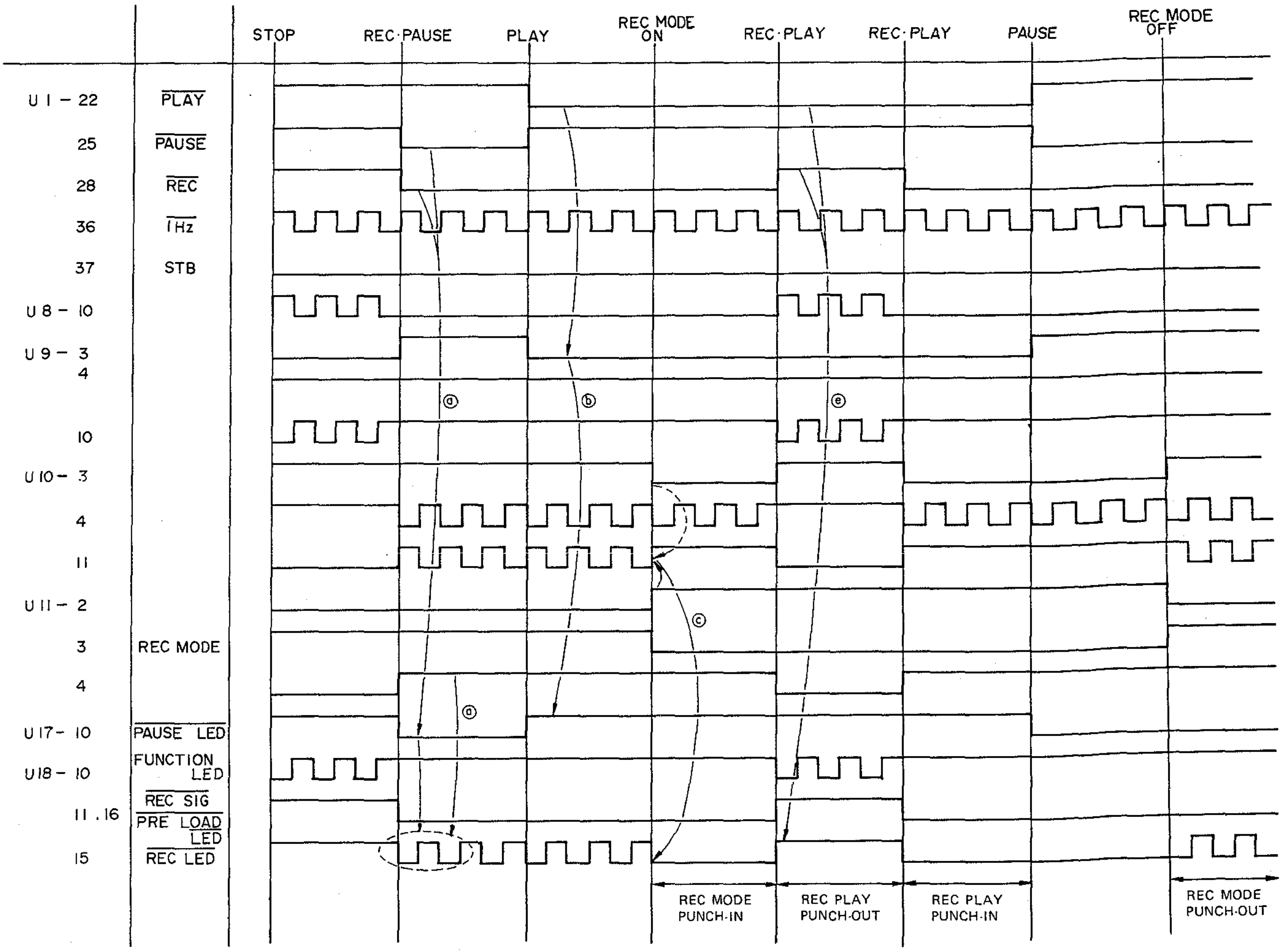


Fig. 5-13. Record Mode Circuit


STOP
REC·PAUSE
PLAY
REC MODE ON
REC·PLAY
REC·PLAY
PAUSE
REC MODE OFF
U 1 − 22
25
28
36
37
U 8 − 10
U 9 − 3
4
10
U 10 − 3
4
11
U 11 − 2
3
4
U 17 − 10
U 18 − 10
11 , 16
15
PLAY
PAUSE
REC
1Hz
STB
REC MODE
PAUSE LED
FUNCTION LED
REC SIG
PRE LOAD LED
REC LED
ⓐ
ⓑ
ⓒ
ⓓ
ⓔ
REC MODE PUNCH-IN
REC PLAY PUNCH-OUT
REC PLAY PUNCH-IN
REC MODE PUNCH-OUT

Note.

1 The record mode can be released by depressing any mode selection button other than PAUSE and play (▶).
2 The record mode is disabled during the STC-Play or RTZ-Play modes of operation.

The small alphabetic letters at the beginning of each description are represented encircled in the timing chart. The encircled letters also indicate the timing sequence in the chart.

Fig. 5-14. Timing Chart for Recording Operations

5-5-9. STC Mode (Search-to-Cue)

The microcomputer has another tape counter inside to register tape positions for searching a cue position on a tape. By pushing the STC button, the STC mode can be set regardless of the transport mode selection. The microcomputer starts the search of the cue position which was previously set through the CUE button, and automatically stops the deck when that designated position is detected. For example, assuming that the beginning of the tape is 00 min. 00 sec., and the CUE button is pressed after the tape has run for 10 min. 00 sec., the 10 min. 00 sec. point is entered into the counter memory and operations continue for the desired length of time (i.e. indicated as 5 min. 00 sec. in the timing chart). When you want to rewind the tape to the 10 min. 00 sec. position, set through the CUE button previously, press the STC button and the tape will be rewound and automatically stopped when it reaches the specified position. This operation is conducted as shown in the Timing Chart in Fig. 5-15. In this figure, description is made with the tape hypothetically running in the fast forward mode, but the same theory can be also applied for operations in the rewind mode.

If the STC button is pressed 5 minutes after the time stored in the internal counter memory (This position is equivalent to -5 min. 00 sec. in the timing chart), the operation mode of the unit is changed to the fast forward mode, and the tape is rapidly wound. When the tape comes within approx. 18 feet (5-1/2 meters) of the designated stop position, the electromagnetic brake is automatically applied (Namely, fast forward mode is changed to rewind mode) to deaccelerate the tape speed. The electromagnetic brake is released when the tape speed is decreased to less than 40 ips (100 cm/sec.), and the mode changes to the LOW speed fast forward mode (Approx. 30 ips (76 cm/sec.)). The tape is then driven at a low speed and when the position corresponding to 10 min. 00 sec. is reached, the mechanical brake is actuated to stop the tape movement. All operations mentioned above are controlled by the internal logics of the microcomputer, to which, signals that indicate the tape running speed and its directions are input, meaning that this operation process can not be seen externally. (Refer to Fig. 5-15.)

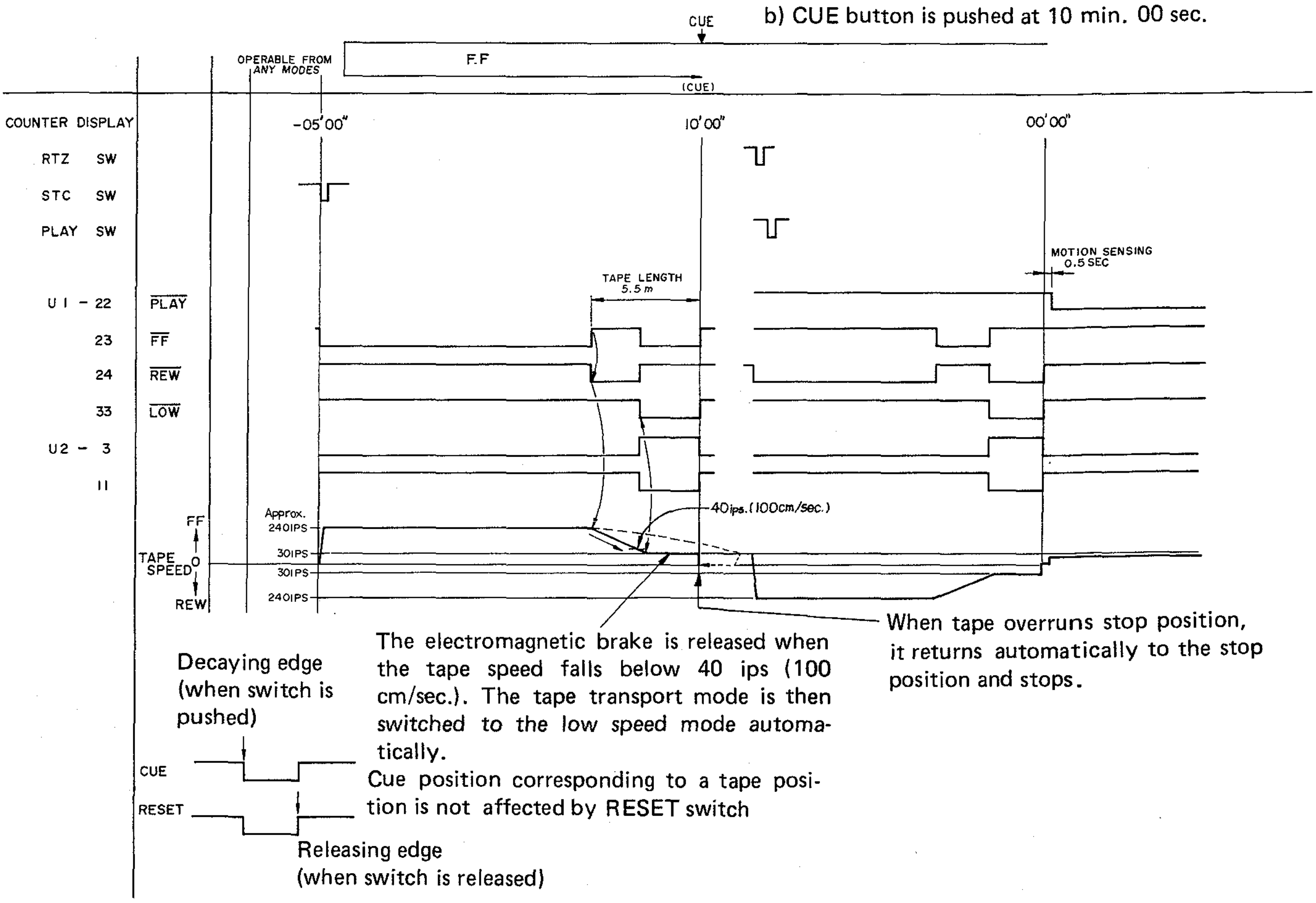
NOTE:

1. If the STC button is pressed within 18 feet (5-1/2 meters) of the cue position, memorized by the CUE button, the tape is driven at a low speed right from the beginning.
2. When the tape speed is not decreased to 40 ips (100 cm/sec.) at the specified position (18 feet (5-1/2 meters) from the setting of the cue position), which is caused by the amount of tape wound on the left and right reels, the tape may overrun the cue position once, but it will return and stop. The stop error indicated is approx. 1 sec.
3. If the CUE button is not pressed, the 00 min. 00 sec. factor will be automatically memorized as a cue position when the power is turned on the next time. The cue position is always determined by the pressing of the CUE button. The tape position corresponding to the cue position will not change even if the RESET button is pressed after the cue position is set.

5-5-10. RTZ Mode (Return-to-Zero)

Operations are the same as those in the STC mode except that the memorized position corresponds to the 00 min. 00 sec. position on the digital counter.

The timing chart is written on assumption that:
a) BOT is 00 min. 00 sec. and,
b) CUE button is pushed at 10 min. 00 sec.


CUE
OPERABLE FROM ANY MODES
F.F
(CUE)
COUNTER DISPLAY
-05'00"
10'00"
00'00"
RTZ SW
STC SW
PLAY SW
TAPE LENGTH 5.5 m
MOTION SENSING 0.5 SEC
U I - 22
PLAY
23
FF
24
REW
33
LOW
U2 - 3
11
FF
TAPE SPEED
0
REW
Approx. 240IPS
30IPS
30IPS
240IPS
40ips.(100cm/sec.)
CUE
RESET

The electromagnetic brake is released when the tape speed falls below 40 ips (100 cm/sec.). The tape transport mode is then switched to the low speed mode automatically.

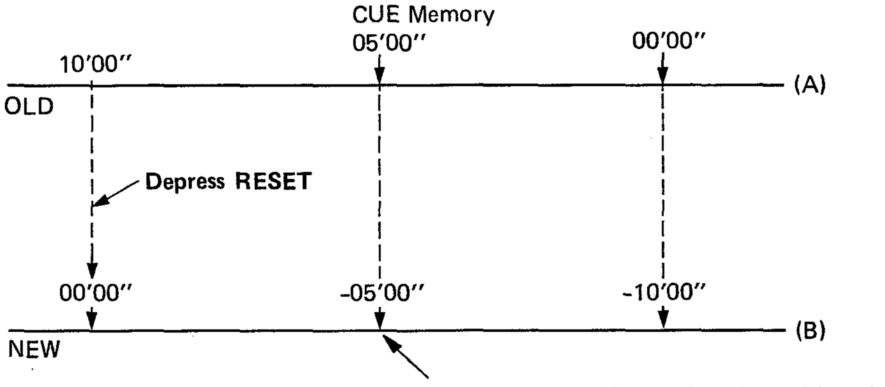
When tape overruns stop position, it returns automatically to the stop position and stops.

Decaying edge (when switch is pushed)

Cue position corresponding to a tape position is not affected by RESET switch

Releasing edge (when switch is released)

Fig. 5-15. Timing Chart for Search Mode


CUE Memory
05'00"
00'00"
10'00"
OLD
(A)
Depress RESET
00'00"
-05'00"
-10'00"
NEW
(B)

Equivalent to OLD cue location, although -05'00" is displayed on counter.

5-6. EXTERNAL CONTROL CIRCUIT

For operation flexibility of the 58, multipin connectors (REMOTE, and ACCESSORY) for external control units have been provided on the rear panel. This section describes the interface circuits used for the external controls.

5-6-1. Remote Control Circuit

Remote control terminals are provided to allow duplication of the 58's front panel controls. Since a parallel-operation type remote control system is employed, the operation theory of the remote control is entirely the same as that described under 5-4 "Entry of Operation Instructions". However, since extending the scanning pulses from the computer to the external remote control circuit may require more complicated circuitry in the operation instruction circuit, an interface circuit, as shown in Fig. 5-16, has been provided between the pin terminals and the microcomputer itself.

1. In the 58's control panel, four phase scanning pulses, sent from the microcomputer, are properly picked-up with the control switches disclosed in a matrix array and returned to the microcomputer under a specific timing status, depending upon the instruction to be performed. However, in the units remote control circuit, as stated, the interface IC U1 (LC7800) is used as an interpreter, which transfers remote control instructions expressed in low logic level signals (non pulse) to the computer, instead of to the switch(es) on the front panel. Since no pulses are used in the remote control circuit and all instructions are transferred to the computer through the interface IC by simply grounding a line corresponding to an operating instruction, remote control operation is carried out in a stable manner.
2. Diodes, D1~D30, connected to terminals 1~6, 9~12, 16, and 23~26 of U1, are provided as protector circuits for abnormal input and output signals.
   Transistors Q1~Q4 are used to invert scanning pulses sent from the computer.
3. Numerous other control lines are connected to the REMOTE control connectors. For their uses, refer to the operating function table on page 5-25.

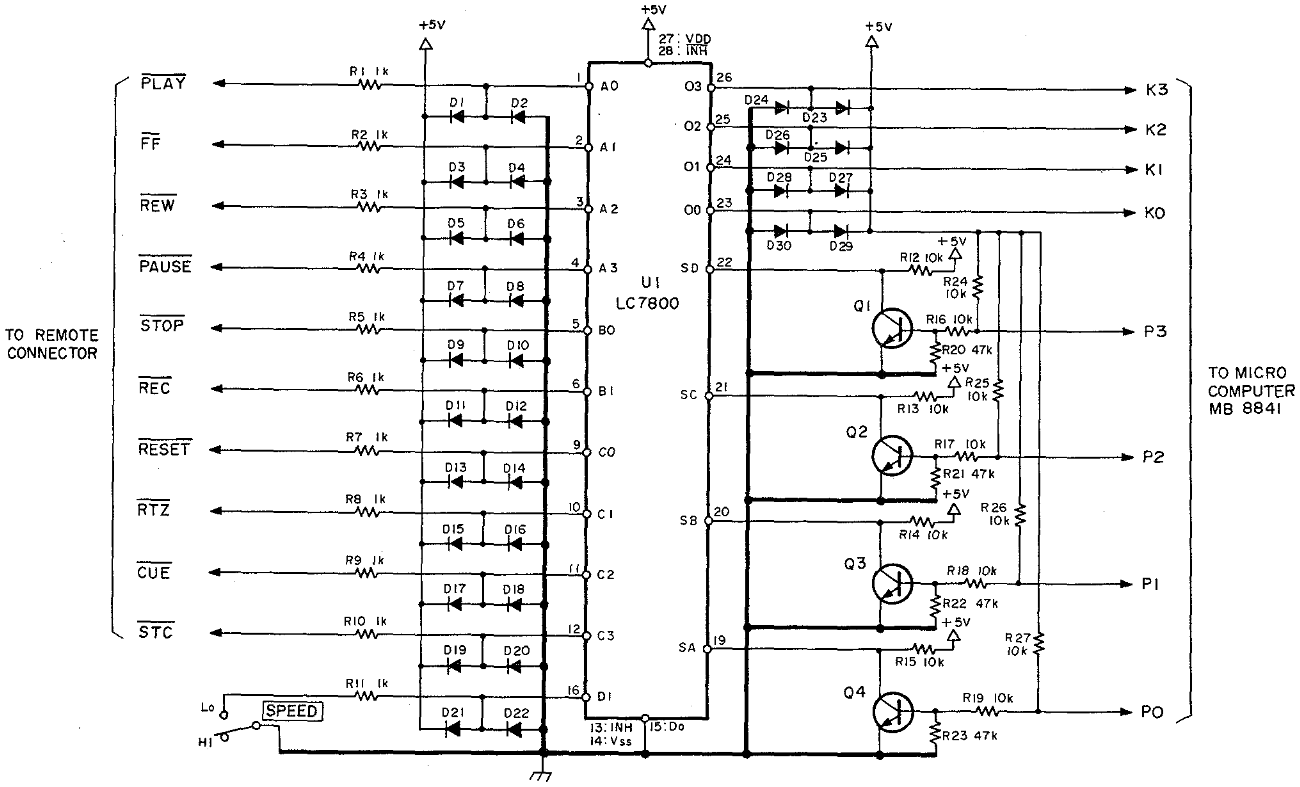

TO REMOTE CONNECTOR
PLAY
FF
REW
PAUSE
STOP
REC
RESET
RTZ
CUE
STC
SPEED
Lo
HI
R1 1k
R2 1k
R3 1k
R4 1k
R5 1k
R6 1k
R7 1k
R8 1k
R9 1k
R10 1k
R11 1k
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
D17
D18
D19
D20
D21
D22
+5V
27: VDD
28: INH
A0
A1
A2
A3
B0
B1
C0
C1
C2
C3
D1
U1
LC7800
O3
O2
O1
O0
SD
SC
SB
SA
13: INH
14: Vss
15: Do
D23
D24
D25
D26
D27
D28
D29
D30
Q1
Q2
Q3
Q4
R12 10k
R13 10k
R14 10k
R15 10k
R16 10k
R17 10k
R18 10k
R19 10k
R20 47k
R21 47k
R22 47k
R23 47k
R24 10k
R25 10k
R26 10k
R27 10k
K3
K2
K1
K0
P3
P2
P1
P0
TO MICRO COMPUTER MB 8841

Fig. 5-16. Remote Control Interface Circuit

5-6-2. ACCESSORY Circuit for External Synchronization

This section describes some interface circuits that are connected to the ACCESSORY connector.

A. Remote Control Circuit

Control lines connected to pins A~F are identical to lines described under 5-6-1 "Remote Control Circuit", so description regarding this circuit will be omitted.

B. Fast Forward and Rewind Tally Circuits (pins N, P)

These circuits supply information that the deck is operating in fast forward or rewind mode to the external equipment connected to the 58, and operate as follows: (Refer to Fig. 5-17.)

1. The anode side of D36 is connected to pin 15 of U7 on the control circuit and logic L level signal is applied to the anode during FAST tape travel, and an H level signal is applied during the other remaining tape travel modes. As the result, Q9 is cut off during FAST tape travel mode, resulting in D32 and D35 cutting off. When Q9 is turned on during the remaining tape travel modes, both Q5 and Q8 base voltages decrease to L, turning them off. In other words, Q5 and Q8 operating status do not change during any mode other than the FAST mode of operation if the UP/DOWN signal is changed.
2. During forward mode of operation, anode side of D33 goes H and this turns on Q7, which in turn makes Q6 and Q8 cut off. Then Q5 is turned on and its collector voltage goes L, thus indicating that the deck is being operated in a FAST forward mode. On the other hand, if the deck is being operated in the rewind mode, input to D33 becomes L, then Q5 is cut off and Q8 is turned on (showing L level), thus indicating to the external circuit that the deck is in the rewind mode.

C. Play Tally Circuit (pin M)

A resistor R40 is connected to the Q13 collector which develops an H level signal during play mode of operation (refer to the below control circuits.).

Accordingly, Q10 is turned on during play mode and its collector voltage falls to L, thus indicating to the external circuit that the deck is being operated in the play mode.

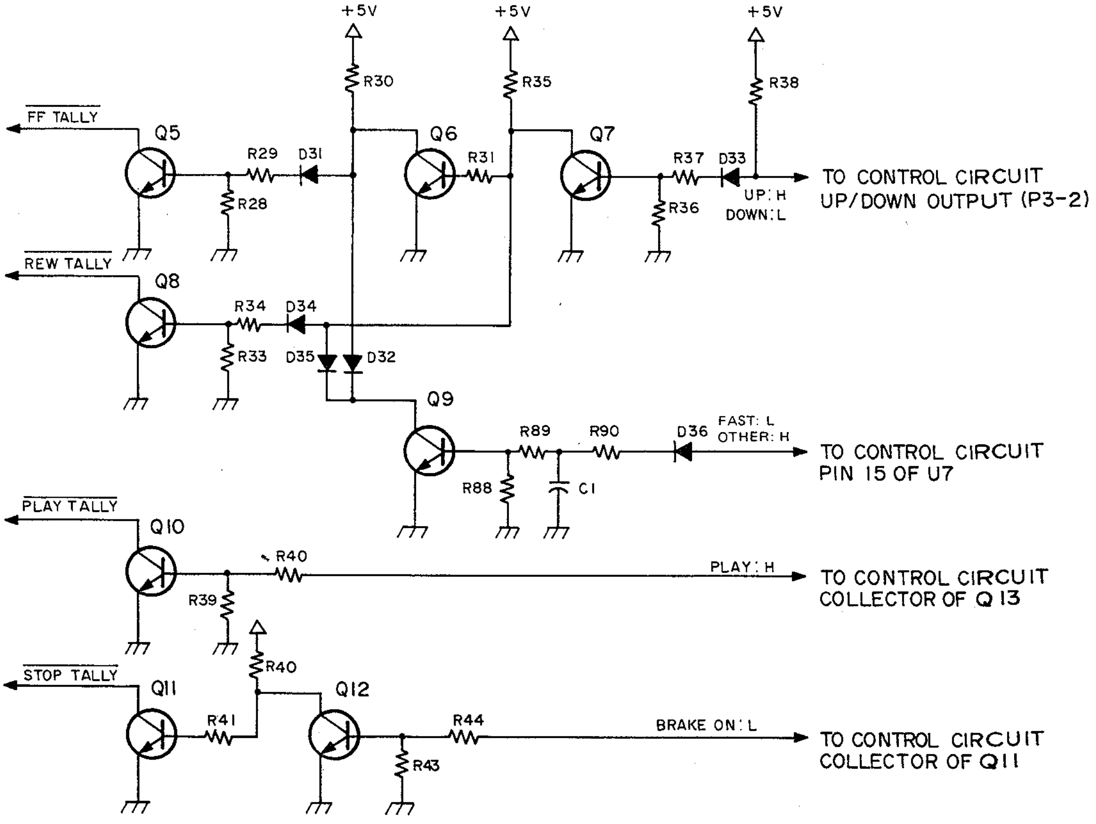

+5V
+5V
+5V
R30
R35
R38
FF TALLY
Q5
R29
D31
Q6
R31
Q7
R37
D33
TO CONTROL CIRCUIT UP/DOWN OUTPUT (P3-2)
UP: H
DOWN: L
R36
R28
REW TALLY
Q8
R34
D34
R33
D35
D32
Q9
R89
R90
D36
FAST: L
OTHER: H
TO CONTROL CIRCUIT PIN 15 OF U7
R88
C1
PLAY TALLY
Q10
R40
PLAY: H
TO CONTROL CIRCUIT COLLECTOR OF Q 13
R39
STOP TALLY
Q11
R40
Q12
R41
R44
BRAKE ON: L
TO CONTROL CIRCUIT COLLECTOR OF Q11
R43

Fig. 5-17. Tally Circuit

D. Stop Tally Circuit (pin R)
This circuit obtains its drive signal from the motor brake circuit, and R44 is connected to Q11 collector (on Control Circuit, not Q11 in Fig. 5-17), which develops an L level signal when the deck is in the stop mode. Consequently, Q12 is cut off and Q11 is turned on during the stop mode of operation, thus indicating to the external circuit that the deck is being stopped.

E. External Pitch Control Circuit (pins KK, LL)
This circuit is used to synchronize the 58's tape speed with external equipment used with the 58, and synchronization is carried out by external pulses supplied from that equipment.

1. The synchronous 9.6 kHz pulse (for nominal tape speed) is first applied to Q13 base and amplified/inverted, and then applied to both Q19 and Q14 bases. However, as each pulse applied to Q19 is differentiated by C7 before it is applied to Q19, Q19 collector develops a very narrow L level pulse with the same period as that of input pulse, as shown in Fig. 5-18 (TP-2), and used as a sampling pulse.
2. On the other hand, each pulse applied to Q14 base is processed as they pass through Q14, Q15, and Q16 to produce an integrated signal across the integrating capacitor C5, (TP-1), as shown in Fig. 5-18 (TP-1). While, the sampling pulse is being applied to Q17 gate, Q17 is turned on during a short sampling (L level) time period. Consequently, only the hatched area of the integrated sawtooth signal is sampled and charged to C6. Since the input and output impedance of FETs Q18 and Q19 are respectively very high, the charges stored in C6 are held without any change until the next sampled pulse is input, thus Q18 source develops an output voltage proportional to the charged voltage held in C6. Since the amplitude of the integrated sawtooth voltage to be sampled is inversely proportional to the frequency of input synchronous signal, the control voltage developed at Q18 source will increase as the frequency of the synchronous signal decreases. The thus obtained DC control signal, which is inversely proportional to the synchronous signal frequency, is applied to pin 3 of the U2 comparator and compared with the reference signal being applied to pin 2 of the comparator, and the amplified difference output controls the speed of the capstan motor, thus maintaining the synchronization to the external equipment.
   R7 (mounted on the Pitch Control PC board) is the trim pot for reference voltage adjustment.
3. On the other hand, Q18's source output is applied to non-inverting terminal pin 5 of U2. In the event where Q18's source output voltage increases too high or the input voltage at pin 5 exceeds the reference voltage at pin 6, pin 7 develops an output voltage and this makes Q20 turn on. As Q20 is turned on, Q21 is turned off. Then, the relay K1 is deenergized and the external pitch control circuit is disconnected and the internal normal pitch control circuit is actuated. Namely, U2 (5, 6, 7) and Q20 function to automatically disconnect the external pitch control circuit when abnormal synchronous signals above the specified range enter.

F. For functions of remaining connector terminals, refer to pages 5-26 and 5-27.

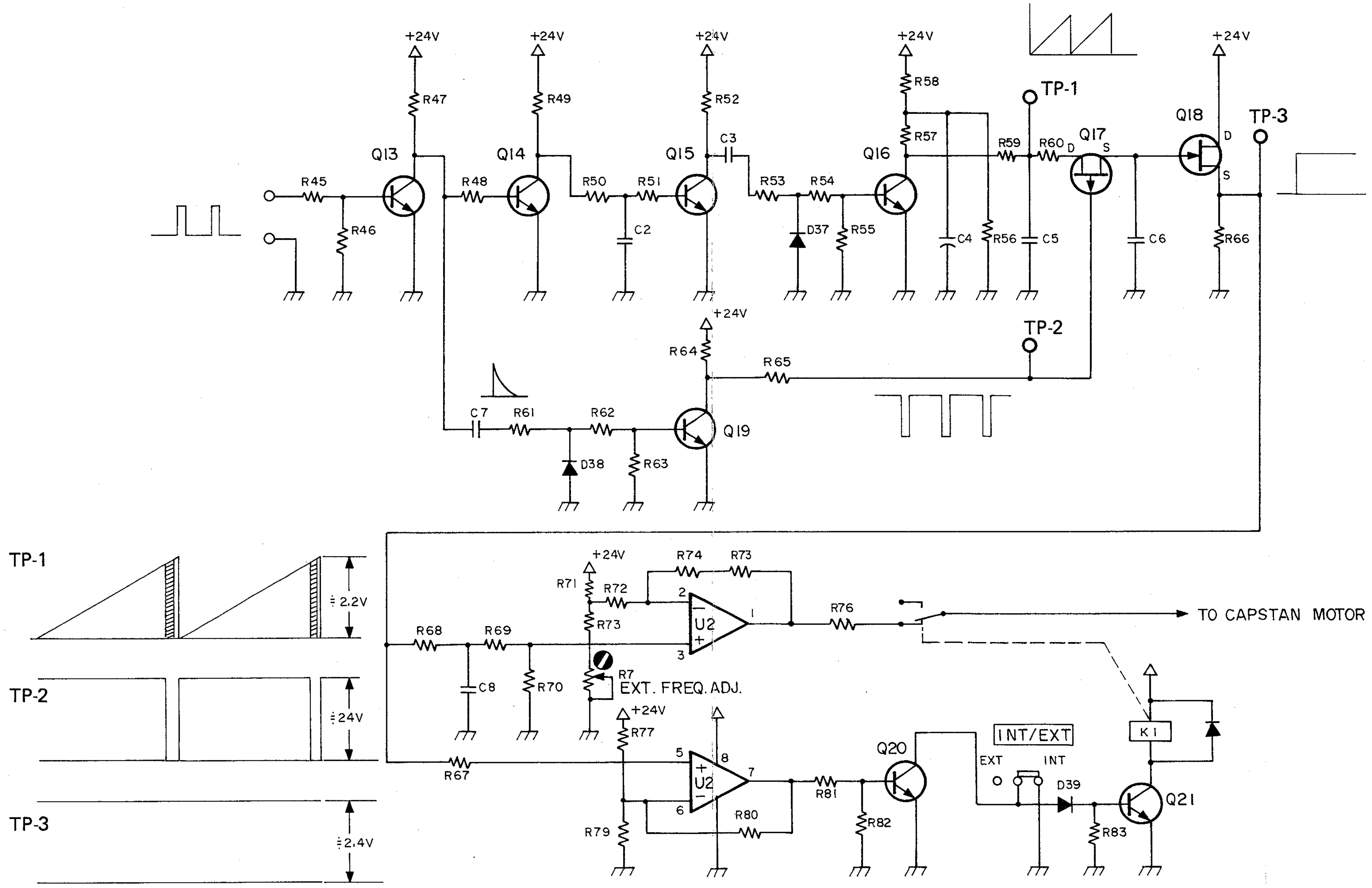

+24V
R47
R49
R52
R58
R57
Q13
Q14
Q15
Q16
Q17
Q18
D
S
TP-1
TP-3
R45
R46
R48
R50
R51
C2
C3
R53
R54
D37
R55
C4
R56
C5
R59
R60
C6
R66
R64
R65
TP-2
C7
R61
R62
D38
R63
Q19
TP-1
≑ 2.2V
TP-2
≑24V
TP-3
≑2.4V
R68
R69
C8
R70
R71
R72
R73
R74
R73
U2
2
3
1
R7
EXT. FREQ. ADJ.
R76
TO CAPSTAN MOTOR
R77
R67
5
8
6
7
R79
R80
R81
R82
Q20
INT/EXT
EXT
INT
D39
R83
Q21
K1

Fig. 5-18. External Pitch Control Circuit

5-6-3. "REMOTE" Connector Signals

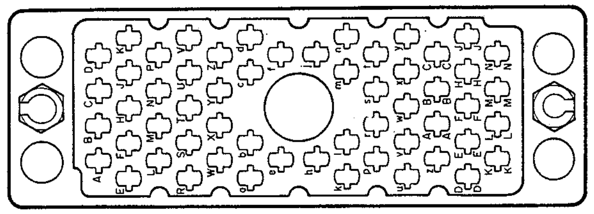


Fig. 5-19.

Pin #	IN(put)–OUT(put) signals	Function
A	(–) SIGN OUT	Outputs counter display signal (Connected in parallel to deck)
B	P3 OUT	
C	P2 OUT	
D	P1 OUT	
E	P0 OUT	
F	$\overline{\text{a}}$ OUT	
H	$\overline{\text{b}}$ OUT	
J	$\overline{\text{c}}$ OUT	
K	$\overline{\text{d}}$ OUT	
L	$\overline{\text{e}}$ OUT	
M	$\overline{\text{f}}$ OUT	
N	$\overline{\text{g}}$ OUT	
P	$\overline{\text{PLAY}}$ IN	Inputs transport control signal (Via interface circuit)
R	$\overline{\text{FF}}$ IN	
S	$\overline{\text{REW}}$ IN	
T	$\overline{\text{PAUSE}}$ IN	
U	$\overline{\text{STOP}}$ IN	
V	$\overline{\text{REC}}$ IN	
W	$\overline{\text{RESET}}$ IN	
X	$\overline{\text{RTZ}}$ IN	
Y	$\overline{\text{CUE}}$ IN	
Z	$\overline{\text{STC}}$ IN	
a	$\overline{\text{REC LED}}$ OUT	Outputs remote-control indicating signal (Connected in parallel to deck)
b	$\overline{\text{PAUSE LED}}$ OUT	
c	$\overline{\text{SPOOL LED}}$ OUT	
d	UP/$\overline{\text{DOWN}}$ OUT	Outputs service signal
e	CP OUT	
f	$\overline{\text{REMOTE LOW}}$ IN	
h	Open terminal IN	
j	+5 V supply voltage OUT	

Pin #	IN(put)–OUT(put) signals	Function
k	0 V (+5 V Vcc)	
l	↑	
m		
n	Open terminal	
p		
r		
s	↓	
t	+15 V supply voltage OUT	
u	MUTE IN	FUNCTION Input/Output signal (For conversion between the remote control unit and deck
v	SYNC IN	
w	$\overline{\text{CH-1}}$ IN	
x	$\overline{\text{CH-2}}$ IN	
y	$\overline{\text{CH-3}}$ IN	
z	$\overline{\text{CH-4}}$ IN	
AA	$\overline{\text{CH-5}}$ IN	
BB	$\overline{\text{CH-6}}$ IN	
CC	$\overline{\text{CH-7}}$ IN	
DD	$\overline{\text{CH-8}}$ IN	
EE	INPUT IN	
FF	REC MODE IN	
HH	FUNCTION LED OUT	
JJ	PRE-LOAD LED OUT	
KK	PLAY MUTE OUT	
LL	0 V (+15 V Vcc)	
MM	Open terminal	
NN	Main body GND	

5-6-4. "ACCESSORY" Connector Signals

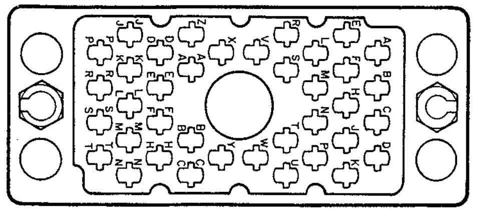
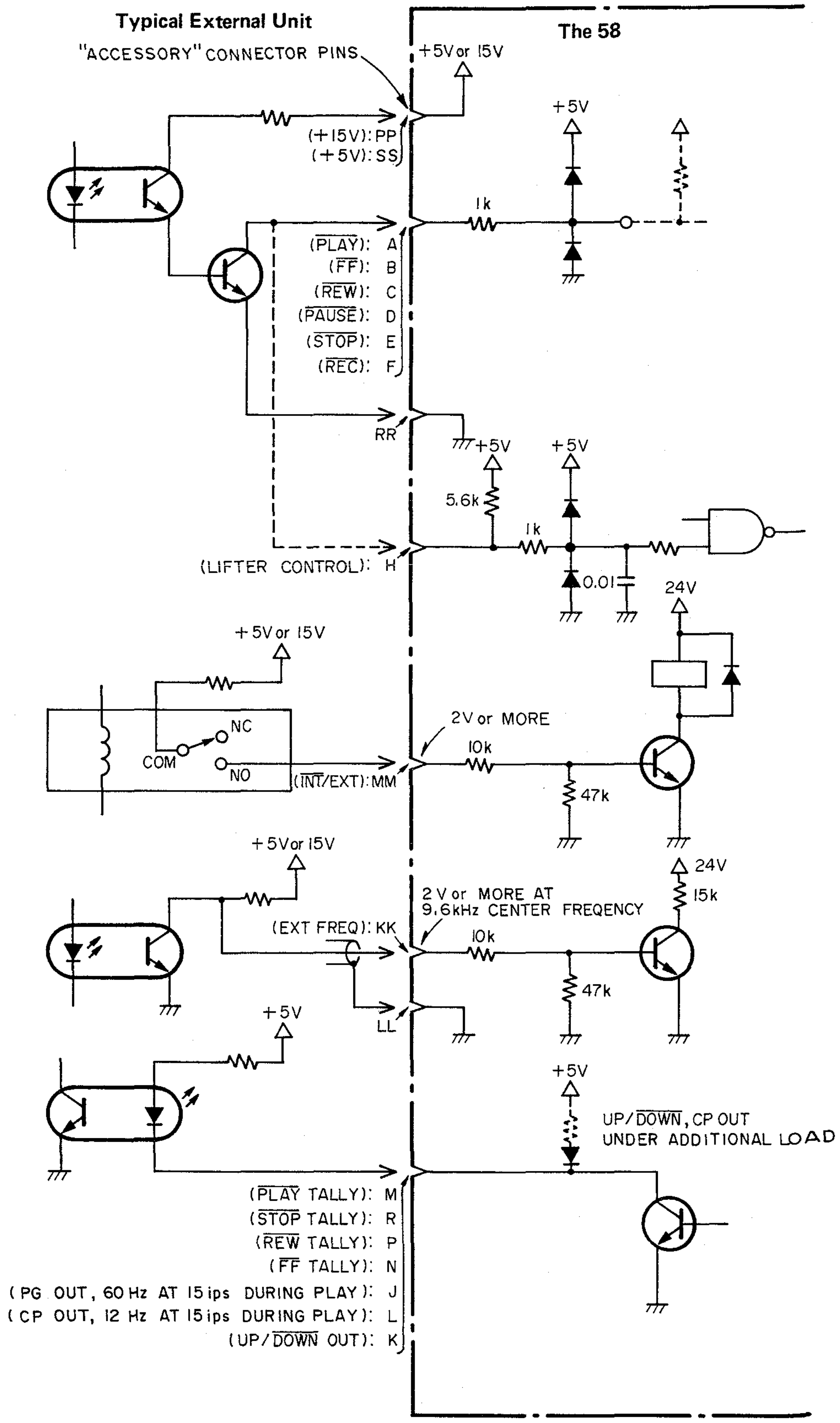


Fig. 5-20.

Pin #	IN(put)–OUT(put) signals	Function
A	$\overline{\text{PLAY}}$ IN	Inputs PLAY signal at L level.
B	$\overline{\text{FF}}$ IN	Inputs FF signal at L level.
C	$\overline{\text{REW}}$ IN	Inputs REW signal at L level.
D	$\overline{\text{PAUSE}}$ IN	Inputs PAUSE signal at L level.
E	$\overline{\text{STOP}}$ IN	Inputs STOP signal at L level.
F	$\overline{\text{REC}}$ IN	Inputs REC signal at L level.
H	$\overline{\text{LIFTER CONT}}$ IN	Inputs LIFTER shift cancellation signal at L level.
J	PG OUT	Outputs open-collector signal (60 Hz pulse at 15 ips.)
K	UP/$\overline{\text{DOWN}}$ OUT	Outputs tape running control signal at H or L level.
L	CP OUT	Outputs open-collector signal (12 Hz pulse at 15 ips.)
M	$\overline{\text{PLAY}}$ TALLY OUT	Outputs open-collector signal (LOW level during PLAY mode.)
N	$\overline{\text{FF}}$ TALLY OUT	Outputs open-collector signal (LOW level during FF mode.)
P	$\overline{\text{REW}}$ TALLY OUT	Outputs open-collector signal (LOW level during REW mode.)
R	$\overline{\text{STOP}}$ TALLY OUT	Outputs open-collector signal (LOW level during STOP mode.)

Pin #	IN(put)–OUT(put) signals	Function
S	↑	
T		
U		
V		
W		
X		
Y		
Z	open terminal	
AA		
BB		
CC		
DD		
EE		
FF		
HH		
JJ	↓	
KK	EXT FREQ IN (HOT)	Inputs speed control signal at input signal level of 2.0 V or more. (HOT side)
LL	EXT FREQ IN (COLD)	Inputs speed control signal (COLD side)
MM	$\overline{\text{INT}}$/EXT IN	Inputs internal/external speed control select signal Internal: LOW level (0 V) External: HIGH level (2.0 V or more) When "INT/EXT" switch on rear panel is in the "EXT" position.
NN	open terminal	
PP	+15 V supply voltage OUT	Maximum: 50 mA
RR	0 V terminal	
SS	+5 V supply voltage OUT	Maximum: 50 mA
TT	Main unit GND	

5-6-5. "ACCESSORY" Connector Pins and External Signal Connections



Typical External Unit
"ACCESSORY" CONNECTOR PINS
The 58
+5V or 15V
(+15V): PP
(+5V): SS
+5V
1k
(PLAY): A
(FF): B
(REW): C
(PAUSE): D
(STOP): E
(REC): F
RR
+5V
+5V
5.6k
1k
(LIFTER CONTROL): H
0.01
24V
+5V or 15V
NC
COM
NO
(INT/EXT): MM
2V or MORE
10k
47k
+5V or 15V
24V
15k
2V or MORE AT 9.6kHz CENTER FREQENCY
(EXT FREQ): KK
10k
47k
LL
+5V
+5V
UP/DOWN, CP OUT UNDER ADDITIONAL LOAD
(PLAY TALLY): M
(STOP TALLY): R
(REW TALLY): P
(FF TALLY): N
(PG OUT, 60 Hz AT 15 ips DURING PLAY): J
(CP OUT, 12 Hz AT 15 ips DURING PLAY): L
(UP/DOWN OUT): K

Fig. 5-21.

5-7. AMPLIFIER CONTROL CIRCUIT

The description will be made on the REC/PLAY AMPL, FUNCTION A and FUNCTION B PCB ASSY circuits shown in Fig. 5-24 on page 5-34, so fold out this page and refer to it while following this description.

5-7-1. Input Mode

When the OUTPUT SELECT switch on the FUNCTION B PCB is placed in the INPUT position, a +15 V line voltage passes through the contacts of the INPUT switch to flow to the inverter U2 (2, 15) on the FUNCTION B PCB ASSY, causing U2 to develop a L level output at its output terminals or $\overline{\text{INPUT Sig.}}$ terminal. Thus produced, the L level output is then fed to the INPUT terminal of the REC/PLAY AMPL PCB ASSY.

The L level signal sent to the INPUT terminal is fed through U6 (11, 12) to D13, and then sent back to the inverter U6 (14, 15) for voltage shifting to approx. -5 V via a resistor network consisting of R60, R61 and R62. The negative voltage is applied to the FET switch Q12 through D2, making it turn off.

On the other hand, the output voltage from pin 15 of U6 inverter is also fed to pin 3 of another U6 inverter, and its output voltage is fed to Q13 gate after the voltage is shifted to approx. +5 V via a resistor network consisting of R64, R65 and R66, thus making Q13 conductive. The INPUT signals are accordingly output to the OUTPUT terminals after passing through C19, U3 (1, 2, 3) – an input buffer amplifier, R206, Q13, U2 (1, 2, 3) – an output amplifier, and C17 and R37. In other words, input signals are output via an OUTPUT terminal regardless of operations such as REC, PLAY, etc.

With the INPUT switch placed in the ON position, a +15 V line voltage is also applied to the INPUT indicator LED D2 (red) on the LED PCB to turn the LED on.

5-7-2. Reproduce Mode

When the OUTPUT SELECT switch is placed in the REPRO position with the reproduce mode selected, the mode indicator LED D1 (Green) on the LED PCB is connected to the +15 V line and turned on. Since the PLAY MUTE Signal goes L during the reproduce mode as described in 5-5-1, an L level signal is input to pin 7 of the inverter U2 on the FUNCTION A PCB ASSY, and its output pin 10 develops an H level signal. (Hereinafter, description will be made on the REC/PLAY AMPL PCB ASSY, so refer to this diagram.) The H level output is connected to terminal 19 of the REC/PLAY AMPL PCB ASSY to turn Q15 on. This is turn, turns on PLAY MUTE transistor Q9 to release the muting circuit. With the reproduce mode selected, U6 (11, 12) input is supplied from the +15 V line, causing it to go H as terminal 16 (INPUT) is opened. Therefore, U6 (11, 12), U6 (14, 15) and U6 (2, 3) are inverted from as originally described under the INPUT mode of operation which causes Q13 to turn off and Q12 to turn on. In other words, reproduce signals are now obtainable from the OUTPUT terminals.

Furthermore, because the SYNC signal is in a non-SYNC state (H), Q17 is turned off and relay K1 is switched to the REPRO side, causing Q10 to turn on. This means that the reproduce circuit is able to function normally.

5-7-3. SYNC Mode

When the OUTPUT SELECT switch is placed in the SYNC position:

a. A +15 V line voltage is supplied to the SYNC indicator LED D2 (yellow) on the LED PCB to turn the LED on.

b. The +15 V voltage being charged in C4 (FUNCTION B PCB ASSY) is applied to pin 5 of U2 (FUNCTION A PCB ASSY) and makes the output pin 12 change to an level. Then, in turn, the charges stored in C2 on the FUNCTION A PCB ASSY are rapidly discharged through resistor R18 on the FUNCTION A PCB ASSY, and therefore, the inverting input level of pin 6 of U3 on the FUNCTION A PCB ASSY is virtually kept at an L level until the level increases to the same potential as that of the non-inverting input circuit (pin 5), or until the time approximately equal to the charging time constant of C2 (R17 + R18) has elapsed. U3 outputs a positive pulse with a pulsewidth determined by the charging time constant C2 (R17 + R18). The pulse is then inverted with U2 on the FUNCTION A PCB ASSY and an L level pulse output is obtained from pin 10 of U2.

When the SYNC switch is turned off, electric charges stored in C3 on the FUNCTION B PCB ASSY is applied to pin 5 of U2 and the same operation just described above is actuated. Namely, when the SYNC switch is turned on or off, a PLAY MUTE signal is developed at pin 10 of U2 for a brief period of time to suppress switching noises. Refer to Fig. 5-22.

c. When the SYNC mode is selected, a +15 V line voltage is applied to input pin 4 of U2 on the FUNCTION A PCB ASSY and causes its output pin 13 to turn to an L level. Then, the charges stored in C1 on the FUNCTION A PCB ASSY discharge through R12 on the FUNCTION A PCB ASSY to keep the input terminal 2 of U3 on the FUNCTION A PCB ASSY positive until the inverting input terminal potential exceeds the potential at the non-inverting input terminal of U3. Therefore, pin 1 of U3 becomes H, after the time approximately equal to the discharging time constant of C1 and R12 on the FUNCTION A PCB ASSY has elapsed. In the same way, when the SYNC switch is placed in the OFF position, pin 1 of U3 goes H, after being delayed for a time period approximately equal to another charging time constant of C1 (R11 + R12). The thusly obtained H level signal is fed to U2 on the FUNCTION A PCB ASSY and inverted as a SYNC Sig. The inverted L level SYNC Sig. is applied to U6 (9, 10) on the REC/PLAY AMPL PCB ASSY and then fed to transistor Q17 on the same PCB to make it turn on. Then, relay K1 is actuated during the time that the PLAY MUTE operation is activated, and its contacts are switched to the SYNC side for selection of the SYNC head to turn Q11 on, etc. and to perform other required switching operations.

d. When the OUTPUT SELECT switch is placed in the SYNC position, input signals are selected and processed as shown in the table below, depending upon the combined settings of the PLAY and REC operating buttons, INPUT/SYNC (preload) switch, and REC function (ON-OFF) switch. The corresponding LEDs are also actuated as shown in the table.

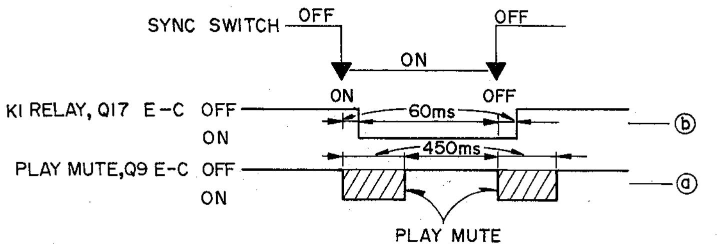


Fig. 5-22. Play Muting

OUTPUT SELECT Switch	REC Function Switch	Pre-load (SYNC/INPUT) Switch	RECORD Switch	Operating Mode	LINE OUTPUT Source
REPRO	–	–	–	–	Repro Head
INPUT	–	–	–	–	Line Input
SYNC	OFF (□)	–	– Ⓐ	–	Sync Repro
	ON (▭)	INPUT (□)	– Ⓑ	–	Line Input
		SYNC (▭)	OFF	In Stop, Fast Winding Modes, or RTZ or STC	Line Input
				In Play, Pause, Edit and Cue Modes	Sync Repro
			ON	–	Line Input
LED on above the switch pressed.	LED flashes with RECORD switch off, and stays on with RECORD switch on.	LED is on with RECORD switch off, and is off with RECORD switch on.	LED flashes with REC function switch off, and is on with REC function on.		

* "–" signifies that the setting of the switch or the operating mode has no effect on the line output source.

Table 5-1. Monitor Out Control

Monitor signal switching operations are made as shown in Table 5-1Ⓐ when REC ON-OFF (punch-in and punch-out) operations are conducted.

When the pre-load SYNC switch is set to "off" SYNC position during the record mode, output pin 4 of U5 goes H because pins 5 and 6 of U5 are being set to L, and an H level signal is applied to input pin 14 of U6 through D12. Since the above condition is the same as that of the previously describe INPUT mode, the INPUT signals are output and monitored. When the REC function switch is placed in the OFF position, input pin 5 of U5 goes H and this makes output pin 4 of U5 (NAND unit) L. Consequently, the amplifier circuit is switched to the SYNC reproduction mode and the SYNC signals are monitored.

Table 5-1Ⓑ also denotes the monitor signal switching operations as functions of the pre-load switch.

When the pre-load SYNC switch is set to "off" (INPUT) during the reproduce mode with the OUTPUT SELECT switch set to SYNC and the REC function switch ON, output pin 10 of U5 (NAND unit) goes L, because input pins 8 and 9 are both in L. Namely, the same condition as that of the INPUT mode is established, and the INPUT signals are monitored.

On the other hand, when the pre-load SYNC switch is placed in "on" (SYNC) position, input pin 1 of U1 in the Function A PCB circuits and input pin 8 of U5 in the Record/Playback Amp. PCB are changed to L. Then, output pin 10 of U5 (NAND unit) is changed from H to L which in turn, makes the operations mode of the amplifier change from INPUT to SYNC, and thus the SYNC signals are monitored.

5-7-4. Record Mode

Since general descriptions on recording operations have been made under section 5-5-8, only additional information will be given in this section.

As previously mentioned, when the RECORD button is pressed, the REC MODE Sig. terminal goes L, and if a recording channel is designated by the selection of the REC function (ON-OFF) switch, the REC READY Sig. corresponding to the channel selected also goes L. Then, pins 12 and 13 of U5 on the Record/Playback Amp. PCB go L and its pin 11 goes H, and transistors Q18 and Q22 on the Record/Playback Amp. PCB turn off because their bases are lowered to L. When Q22 turns off, Q24 goes on and the record relay K2 actuates to switch on the record circuit.

When Q24 turns on, Q25 goes off and pin 5 of U6 on the Record/Playback Amp. PCB goes H, and this causes pin 5 of U5 on the Record/Playback Amp. PCB to decrease to an L level. If the OUTPUT SELECT SYNC switch is being pressed, pin 6 of U5 also goes L, so output pin 6 goes H and Q12 goes off, causing Q13 to go on as described in the input mode of operation to enable monitoring of the input signals via the OUTPUT terminals.

When Q18 on the Record/Playback Amp. PCB is turned off, Q18 collector voltage is applied to the base of Q20, causing it to turn on, followed by Q21 also turning on. Then, the Bias Amplifier module U7 on the Record/Playback Amp. PCB starts to function and supplies bias voltage to the recording and erase heads.

Transistors Q19 and Q23 are turned on by the charging currents being respectively applied through C35 and C36 on the Record/Playback Amp. PCB. Immediately after this, Q19 and Q23 are turned off, causing rapid discharge of the charges stored in C37 and C38 through C37 – R96 and C38 – R108.

That is, without Q19 and Q23, the charges that were stored in C37 and C38 could not be discharged so rapidly, and possibly resulting in Q21 staying on when REC ON-OFF (punch-in and -out) operations are repeated quickly. Transistors Q19 and Q23 function to prevent this erroneous operation.

During recording, an H level signal is applied to terminal 10 on the Function A PCB and Q1 on the same PCB, is turned on. However, during punch-out operation, a 1 Hz pulse signal is applied to the same terminal and the REC function LED(s) designated by the REC (ON-OFF) switch begins blinking.

During the REC mode of operation, an L level signal is being applied to terminal 16 on the Function A PCB, and Q2 on the Function B PCB ASSY is turned off. In addition, as terminal 17 on the Function A PCB is at an H level, Q3 and Q4 on the Function B PCB are turned on, thus switching operations as shown in Table 5-1 can be performed with switching combinations of REC (ON-OFF) and SYNC/INPUT switches.

5-7-5. Record/Reproduction Switching Noise Protection Circuit

Eliminating switching noises caused during record and reproduction switching is very important to enhance operationability of the unit. This section describes how the switching noises are eliminated in this unit. To simplify the description, first suppose that the SYNC and REC function switches are set to ON and the unit is being operated in the sync reproduction mode. For SYNC switch noise protection (generation of muting signals) refer to 5-7-3 "SYNC Mode".

1. When punch-in operation is conducted (or RECORD and play buttons are pushed at the same time), the microcomputer generates record instructions as previously stated and REC terminal 17 on Record/Play Circuit goes L, then output pin 11 of U5 goes H and output pin 6 of U6 also goes L; MUTE terminal 19 on the same circuit schematic also changes from H to L.
2. Since Q15 base bias falls as the MUTE terminal goes L, Q15 is cut off and the voltage at junction R68 and C31 rises for the time period determined by R70 + R68 and C31 time constant. Since voltage is applied to the base of Q9, Q9 is turned on after the time constant time (approx. 25 msec), and the sync reproduction signal is shorted at ground through the emitter-collector path of Q9, thus disconnecting sync output from the OUTPUT terminals. Refer to Fig. 5-23ⓐ.
3. Q22 is cut off as output pin 6 of U6 goes L. Then, +15 V voltage is applied to Q23 base for a brief period of time through C36, and makes Q23 turn on to discharge the residual electric charges stored in capacitor C38. When the charging to C38 is completed, Q23 is again cut off, and C38 charging starts. When this charging to C38 is completed, Q24 is turned on and the REC relay K2 is actuated, thus the record/sync head is switched in the record circuit.
   The time required for this switching has been adjusted to approx. 50 msec through the time constant circuits including C38, R112, C36, R110, etc. Refer to Fig. 5-23ⓑ.
4. Since Q25 base bias decreases as Q24 is turned on, Q25 is cut off, and this turns input pin 5 of U6 to H and output pin 4 to L. Then input pin 5 of U5 goes L. Pin 6 of U5 is in L because SYNC terminal 20 is L (as the SYNC switch has been set to ON). Thus output pin 4 of U5 becomes L.
5. Then output pin 15 of U6 goes L and output pin 2 of U6 goes H. Consequently; the 5 V positive voltage developed by the dividing network, which consists of R64 and R65, is applied to the cathode side of diode D3 through R66, and transistor Q13 is turned on. In this operation Q13 is gradually turned on because of a large time constant provided by R66 and C32. Therefore, the INPUT signal being applied to the drain side of Q13 is transferred to the output side gradually, thus suppressing switching noises in the monitor signals.
6. On the other hand, another voltage dividing network R60 and R61 develops -5 V, as input pin 3 of U6 is in L, and the negative voltage is applied to D2 cathode via R61, cutting Q12 off. In this case also, the cut off operation is accomplished gradually because of a large time constant provided by R61 and C30.
7. In this way, switching operations for both Q12 and Q13 are made under influence of four time constants, each relating to capacitors C36, C38, C39, & C30, and C36, C38, C39, & C32 (as stated in 4, 5 and 6 above). Accordingly, their total time required for switching operation becomes considerably long as shown in Fig. 5-23 (A).
8. When Q18 is cut off, Q19 is turned on until C35 is charged; thereby, discharging the residual charges stored in C37. Then C37 is recharged through R93, R94, R95 and, when recharging is completed, Q20 is turned on. After this, charging to C45 begins through R101, R102 and the charged voltage reaches approx. 0.6 V, which causes Q21 to turn on to actuate the bias oscillator amp. In this way, the operation of bias amp is influenced by the corresponding C35, C37, and C45 time constants, causing the bias oscillator to start functioning at approx. 75 msec, after the punch-in operation has been set, to gradually increase the bias amplitude as shown in Fig. 5-23ⓒ. Accordingly, the amplitude of the signal being recorded on the tape is also gradually changed to the steady state, thus eliminating switching noises.
9. Next, when punch-out operation is made, the microcomputer outputs Play instructions to make the MUTE terminal 19 and also the REC terminal change to H. Accordingly, output pin 11 of U5 goes L, output pin 6 of U6 goes H, and both Q18 and Q22 are turned on.
10. The charges stored in C37 is discharged through D16, R94, Q18 (emitter-collector path) as Q18 is turned on. Then Q20 is cut off, followed by Q21 cutting off. The time required to cut Q21 off depends upon the sum of the discharging time constants of C37 and C45, and is set to approx. 205 msec, as shown in Fig. 5-23ⓓ. As the result, the bias oscillator voltage amplitude of the bias amplifier is gradually attenuated as illustrated, and the amplitude of signals being recorded is also attenuated gradually.
11. When Q22 is turned on, the charges stored in C38 is discharged through R107 and Q22 (emitter-collector path), cutting off Q24 as the discharging potential is decreased. Then the REC relay is switched in to the SYNC side. The time required to actuate the REC relay is set to approx. 270 msec, completely after the bias oscillator voltage amplitude has been attenuated to zero. Refer to Fig. 5-23ⓔ.
12. When Q24 is cut off, Q25 is turned on after the time period, determined by the charging time consistant of R113, R114, C39, and this makes input pin 5 of U6 change to L. Then, output pin 4 of U6 or input pin 5 of U5 changes to H. (These pins 4 and 5 are in L until C39 is charged.)
13. Accordingly, output pin 4 of U5 goes L, and output pin 15 of U6 goes H. As the result, +5 V developed by the dividing network, consisting of R60 and R62, is applied to D2 cathode through R61 and this makes Q12 turn on. Because of the large charging time value constant of C30, Q12 is gradually turned on.

14. On the other hand, as output pin 2 of U6 goes L, -15 V voltage is applied across R64 and R65, and the resultant divided voltage (-5 V) is applied to D3 cathode through R66, making Q13 cut off. Since the charging time constant of C32 is also of a considerably large value, the gradual cut off operation is made similarly as that of Q12.
15. When punch-out operation is made, when the pre-load switch (SYNC/INPUT) is set to SYNC, SAFE/RDY terminal 18 on Record/Playback Amp. PCB goes H, and this makes output pin 10 of U5 (or input pin 2 of U5) change to L.
    As previously stated, input pin 5 of U5 is not changed to H immediately after the punch-out operation has been made, but goes to H after Q25 is turned on for a brief time period that is determined by C38, C39, etc. charging time constants. Namely, input pin 5 of U5 is L until Q25 is turned on. Accordingly, output pin 4 of U5 is H, and output pin 3 is L because of input pin 2 of U5 being L.
    On the other hand, MUTE terminal 19 goes H immediately after the punch-out operation, but Q15 base bias voltage is unable to rise because, at this time, output pin 3 of U5 is being set to L. Therefore, Q15 is maintained cut off and Q9 is also held in its conductive state. Next, when Q25 is turned on, input pin 5 of U5 goes H and output pin 4 (or input pin 1 of U5) goes L, causing output pin 3 of U5 to go H. Accordingly, Q15 is turned on, and this makes Q9 cut off, thus releasing the short-out circuit for SYNC reproduction signals. In other words, Q9 can not be turned off until the REC relay completes switching in to the SYNC position. Thus no switching noise is developed in the monitor output circuit. Refer to Fig. 5-23ⓕ.

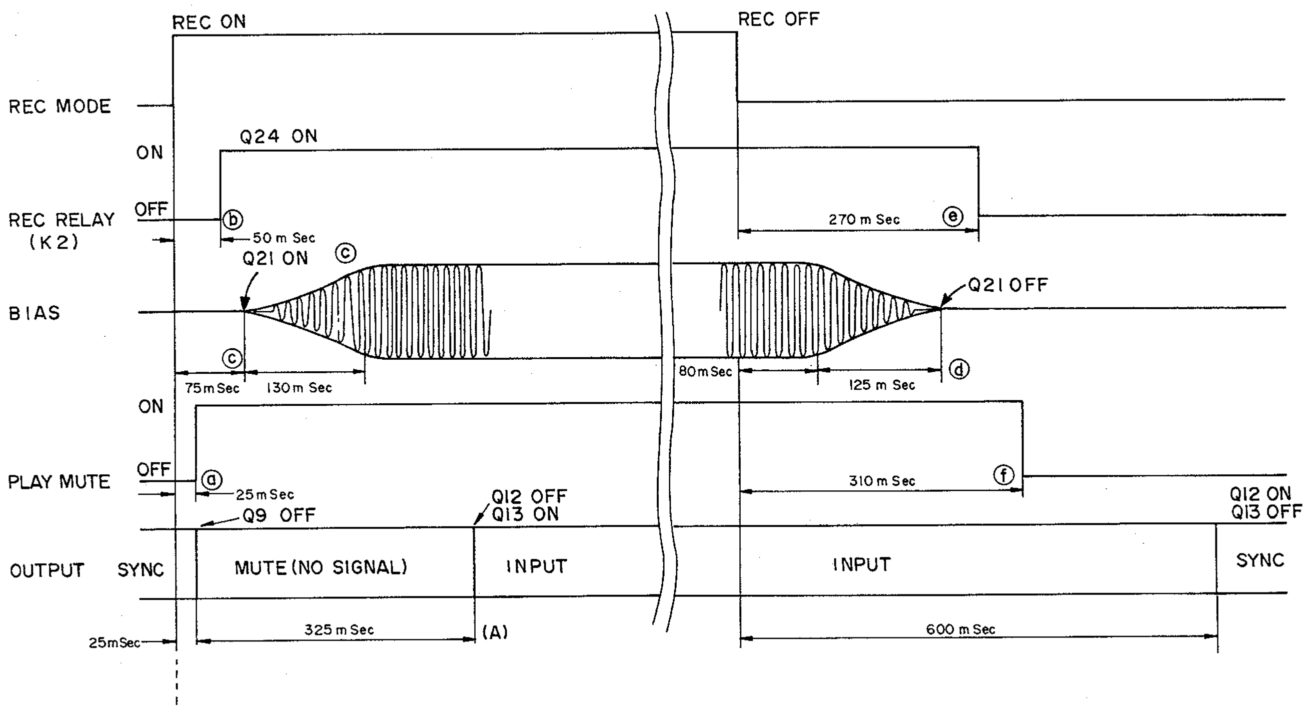


Fig. 5-23.

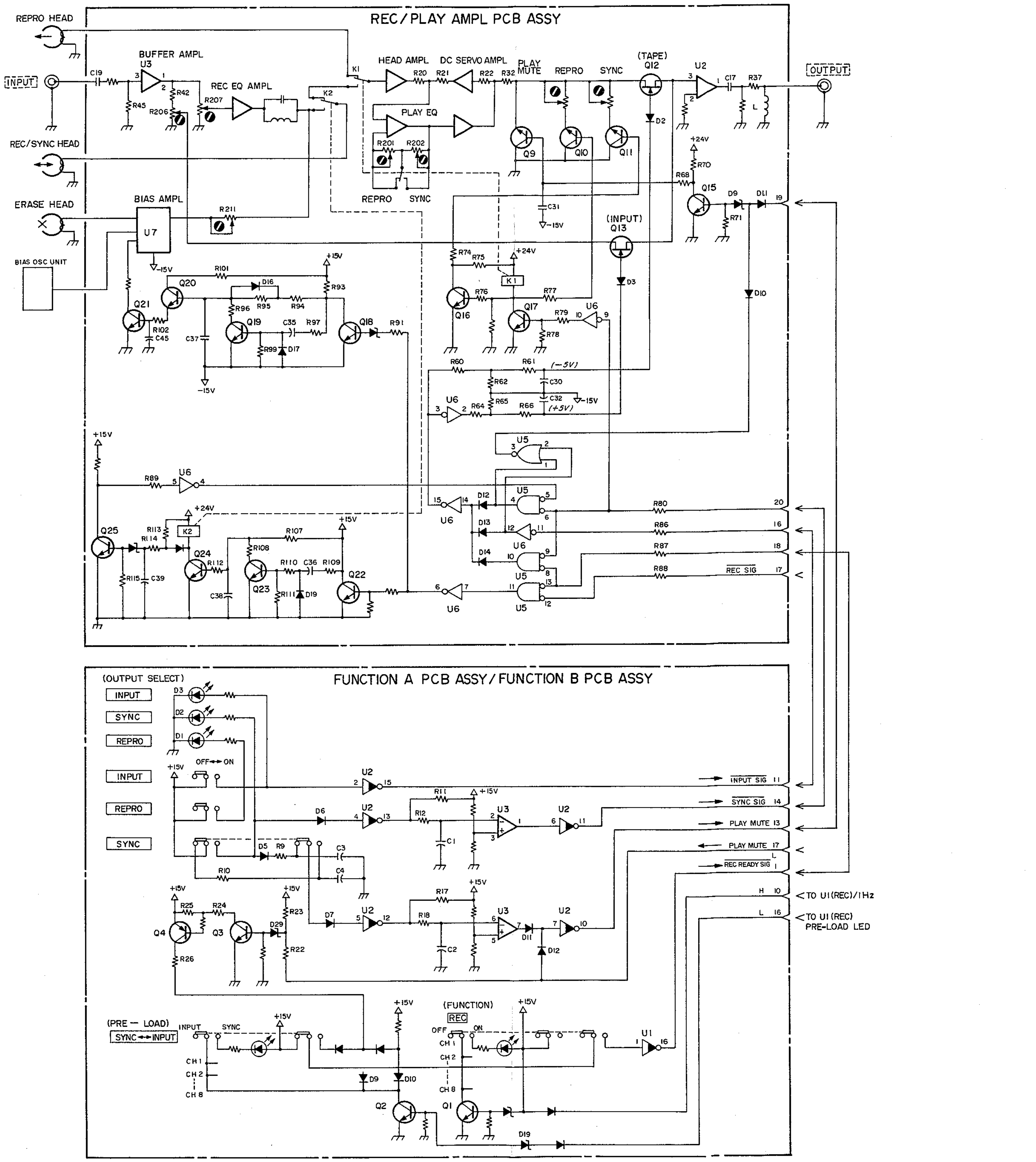
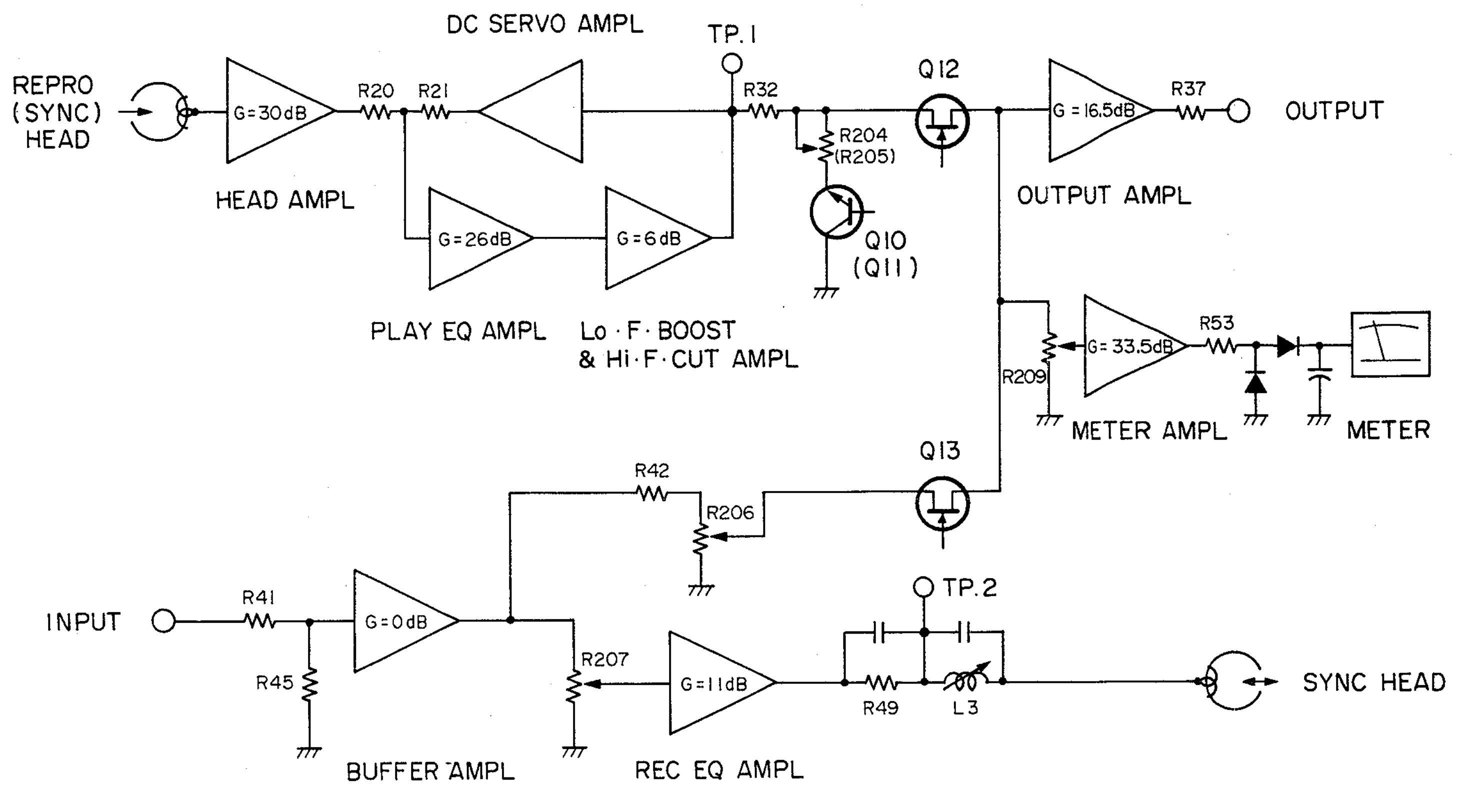
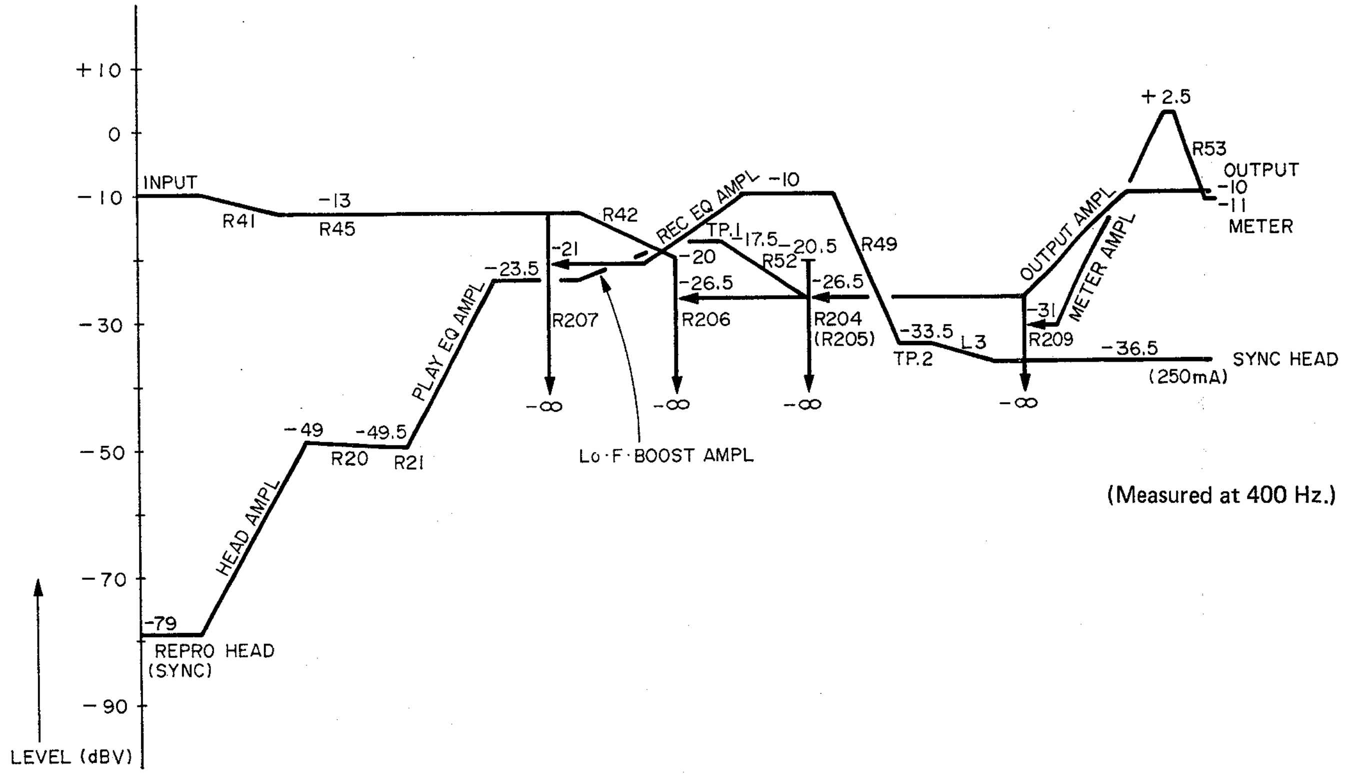

REC/PLAY AMPL PCB ASSY
REPRO HEAD
INPUT
REC/SYNC HEAD
ERASE HEAD
BIAS OSC UNIT
BUFFER AMPL
U3
REC EQ AMPL
HEAD AMPL
DC SERVO AMPL
PLAY MUTE
REPRO
SYNC
(TAPE) Q12
U2
OUTPUT
PLAY EQ
BIAS AMPL
U7
(INPUT) Q13
Q15
U5
U6
REC SIG
FUNCTION A PCB ASSY/FUNCTION B PCB ASSY
(OUTPUT SELECT)
INPUT
SYNC
REPRO
INPUT SIG 11
SYNC SIG 14
PLAY MUTE 13
PLAY MUTE 17
REC READY SIG 1
TO U1 (REC)/1Hz
TO U1 (REC) PRE-LOAD LED
(PRE — LOAD)
SYNC↔INPUT
(FUNCTION)
REC

Fig. 5-24.

5-7-6. Block and Amplifier Level Diagram


REPRO
(SYNC)
HEAD
G=30dB
HEAD AMPL
R20
R21
DC SERVO AMPL
G=26dB
G=6dB
PLAY EQ AMPL
Lo·F·BOOST
& Hi·F·CUT AMPL
TP.1
R32
R204
(R205)
Q10
(Q11)
Q12
G = 16.5dB
R37
OUTPUT
OUTPUT AMPL
R209
G=33.5dB
R53
METER AMPL
METER
Q13
R42
R206
INPUT
R41
R45
G=0dB
BUFFER AMPL
R207
G=11dB
REC EQ AMPL
TP.2
R49
L3
SYNC HEAD



(Measured at 400 Hz.)

6. ROUTINE MAINTENANCE

6-1. BASIC INFORMATION

If you are new to high quality sound recording equipment, you should become aware of the fact that high quality sound requires high quality maintenance.

Recording studios that rent time by the hour are very fussy about maintaining their equipment. Tape recorders and other electronic gear in the studio are checked out before every session. And, if necessary, adjusted to "spec" by an "in house" service technician. He is usually prepared to correct any problem from a minor shift in circuit performance to a major breakdown in a motor. He has a full stock of spare parts and all the test equipment he needs.

Now that you are running your own "studio" you will have to make some decisions about maintaining it, and your 58. You will have to become your own "in house" service technician. Well, what about the test gear and the spare parts? A stock of spare parts and a super deluxe electronic test bench can easily cost many times the price of the recorder. Fortunately, the most frequently needed adjustments use the least expensive equipment, and the very costly devices are only needed for major parts replacements such as drive and rewind motors or head assemblies. Replacing parts cannot be considered "routine maintenance" by any means, so we suggest that you leave the major mechanical and electrical repair to the Dealer Service Center. That's what it's for

Adjustments to the motors – back tension and brake torque are not required often and can safely be left to dealer service. The adjustments for wow-and-flutter require several thousands of dollars of test gear to perform. It's not practical to consider doing these adjustments yourself unless you have fifty machines to service. Then it might pay to buy the test gear.

In order to help you make plans about the more routine adjustments to your 58, we have made this section of the manual as easy to understand as technology will allow. It's a short course in tape recorder theory as well as a list of adjustments and will help you to understand what is going on inside when you record. **Read the manual, decide what test equipment you can afford (although it is not violently expensive, it is not free) and determine what service you can do yourself.**

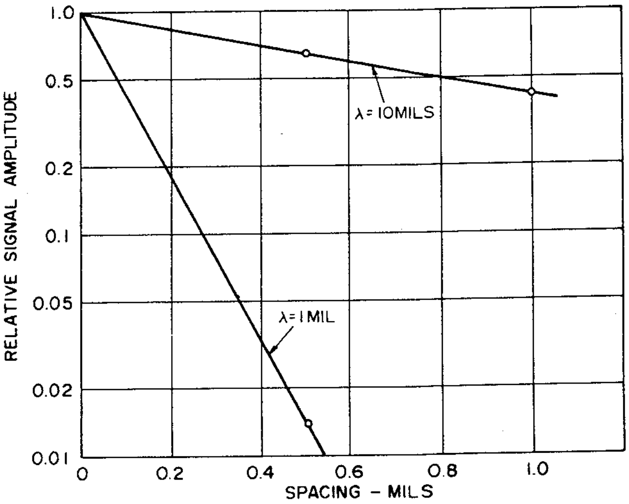


Fig. 6-1. Curves showing fall-off of reproduced signals versus spacing from reproducer head.
(Courtesy, Minnesota Mining and Manufacturing Co.)

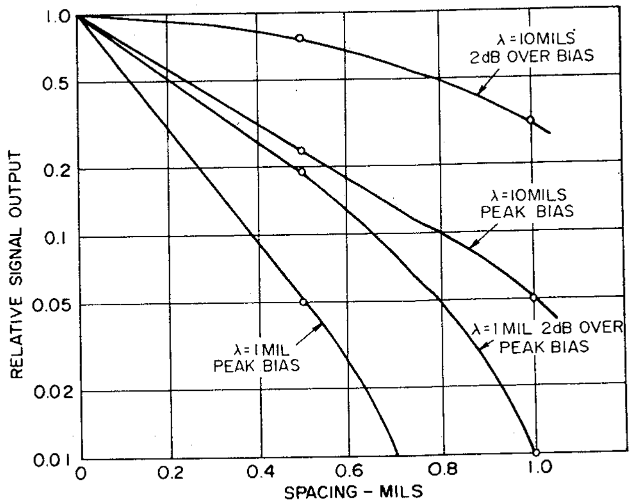


Fig. 6-2. Curves showing the fall-off of recorded signals versus spacing from recording head.
(Courtesy, Minnesota Mining and Manufacturing Co.)

6-1-1. Cleaning

IMPORTANT:

Do not overlook the importance of cleaning. Insufficient cleaning is the number one cause of the degradation of performance levels.

The first thing you will need for service is definitely the least expensive — Cleaning fluids and swabs. The whole outfit, 2 fluids and all the cotton swabs you'll need for months cost less than one roll of high quality tape. We can't stress the importance of cleaning too much. Clean up before every session. **Clean up after every session. Clean up every time you take a break in the middle of a session (we're serious).** How come? Well there are two good reasons we can think of right off the top:

1. Any dirt or oxide buildup on the heads will force the tape away from the gaps that record and playback. This will drastically affect the response. Even so small a layer of dirt as one thousandth of an inch will cause big trouble. All the money you have paid for high performance will be wiped out by a bit of oxide. Wipe it off with head cleaner and get back to normal.
2. Tape and tape oxide act very much the same as fine sandpaper. The combination will grind down the tape path in time. If you don't clean off this abrasive on a regular basis, the wear will be much more rapid and, what's worse, it will become irregular. Even wear on heads can be compensated for by electronic adjustments for a time, but uneven wear can produce notches on heads and guides that will cause the tape to "skew" and skip around from one path to another, making adjustment impossible. This ragged pathway chews up the tape, thus dropping more abrasive, thus causing more uneven wear and so — a vicious spiral that can't be stopped once it gets a good start. The only solution will then be to replace not only the heads, but all the tape guides as well. Being conscientious about cleaning the tape path on the 58 will more than double the service life of the head assembly.

6-1-2. Degaussing (Demagnetizing)

IMPORTANT:

1. **Do not overlook the importance of degaussing. Magnetism in the tape can significantly degrade performance. In extreme cases, the heads may not respond to signals at all.**
2. **Turn off the deck before degaussing.**
3. **Do not turn the degausser (E-3) off or on while it is in close proximity to the tape path.**
4. **Keep all recorded tape a safe distance from the degausser.**

A little stray magnetism goes a long way. A long way towards making trouble for your tapes. It only takes a small amount (.2 gauss) to cause trouble on the record head and playing 10 rolls of tape will put about that much charge on the heads and other ferrous parts of the tape path. A little more than that (.7 gauss) will start to erase high frequency signal on previously recorded tapes. Demagnetize the whole tape path, including the tips of the tension arms every six fully played 10-1/2 reels. This is a fair "rule of thumb" even though it may be a bit hard to keep track of. Fast motion isn't as significant to the heads, so we don't give an hourly reference. It's the record/play time that counts.

Degaussing is always done with the recorder turned off. If you try it with the electronics on, the 60 cycle current pulses produced by the degausser will look just like 60 Hz audio to the heads, at about 10,000 VU and will seriously damage the electronics and/or the meters. Turn off the machine, turn on the degausser at least 3 feet away from the recorder. Move slowly in to the tape path. Move the degausser slowly up and down in close proximity to all ferrous parts and, slowly move away to at least 3 feet before turning off.

It's a good idea to concentrate when you are degaussing. Don't try to hold a conversation or think of anything else but the job you are doing. If the degausser is turned off or on by accident while it is near the heads, you may put a permanent charge on them that no amount of careful degaussing will remove — head replacement time again, we're sorry to say. Make sure you are wide awake for this procedure.

A clean and properly demagnetized tape recorder will maintain its performance without any other attention for quite some time. Even if it does drift as a recorder, it won't ruin previously recorded material, and getting it back in good shape will not be too difficult.

6-1-3. Equipment/Materials

To make electronic adjustments, you need test gear, so let's go over what's necessary.

1. ALIGNMENT TAPES

The one you will need for the speed that the 58 operates at must meet the following specs:

Reference fluxivity: 250 nWb/m
Equalization standard: IEC
15 ips ∞ + 35 μs (See page 6-8; Test Tapes)

These test tapes are made by several companies, but there are many different tape specs. Be sure you have the right one.
Let's talk about each spec separately.
Reference Fluxivity – How much magnetic energy is necessary on the tape to make the meter read "0 VU" in playback? This is the "benchmark" or standard you tune your playback electronics to 250 nano-Webers per meter is the correct value for the 58. If a lower or higher "Reference Fluxivity" is used to set up the playback, all your other measurements will be off.
IEC Equalization – Here we have a lot to talk about. The process of magnetic recording is far from "flat." Every circuit in a tape recorder will alter the level of signal with respect to its frequency – some deliberately, some unavoidably. The deliberate errors are used to overcome the unavoidable problems. Here is a selection of frequency response graphs at various points in the recording process:

1. If the input signal starts this way in the beginning (FLAT).

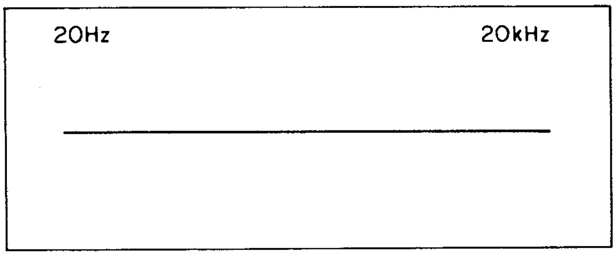


Fig. 6-3.

2. EQ to overcome head loss at high frequency and bass anomalies
   Deliberate error

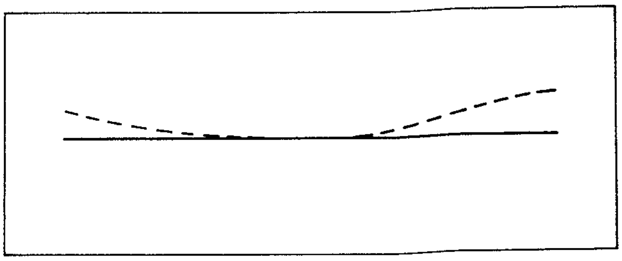


Fig. 6-4.

3. Record Head Response
   (6 dB per octave rise until gap in head approaches wavelength)
   Unavoidable error
   Small wavelengths (high frequencies) are partially erased as fast as they are recorded.

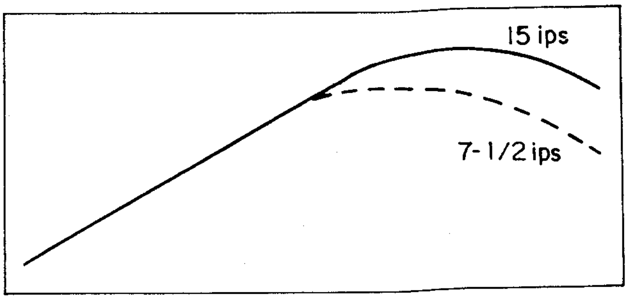


Fig. 6-5.

We will assume something is recorded, but it's not flat on the tape either. Now we'll play it back.

4. Reproduce Head Response
   (6 dB per octave rise again, same as record head).
   Unavoidable error,
   Small wavelengths are not picked up by gap.

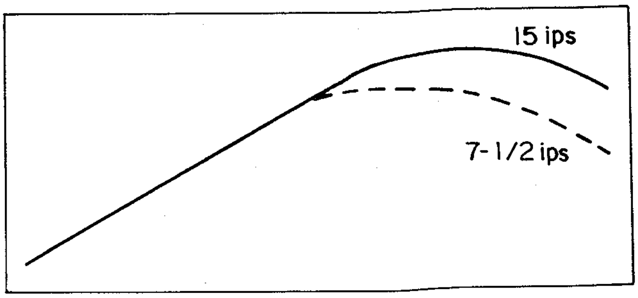


Fig. 6-6.

5. Reproduce EQ
   Now we must overcome the characteristic response of heads.
   Big deliberate error
   Helps lower tape hiss as well as restoring proper levels to high frequencies.

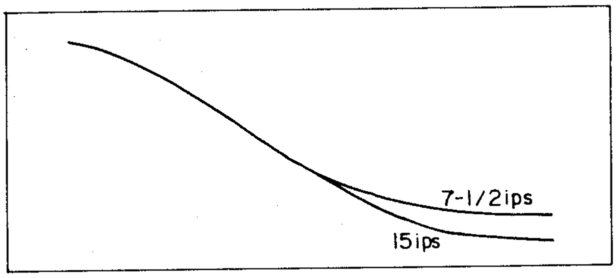


Fig. 6-7.

6. The result of all this equalization is this (hopefully).

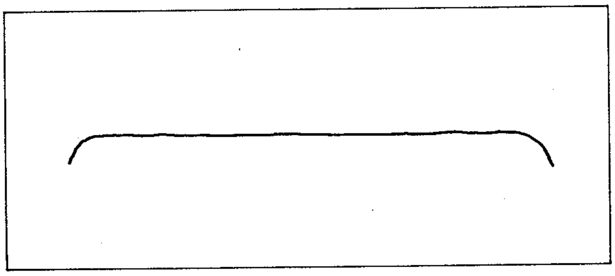


Fig. 6-8.

The idea is to use the electronics that are adjustable to cope with the problems that are caused by the nature of the magnetic recording process. We can't change the basic laws of magnetic physics, so we change the record and reproduce equalization. Now comes the sticky part. How much EQ do we use in each stage? If every manufacturer of tape recorders used their own standard, their idea of what was best, there would be no playback compatibility. Tapes made on one recorder would not play back properly on another of different make. The standards for record and reproduce equalization are established by societies of scientists, engineers and users in the profession. They are:

NAB	National Association of Broadcasters
IEC	International Electrotechnical Commission
CCIR	International Radio Consultive Commision
DIN	Deutsche Industrie Normen

Unfortunately, they don't all agree. Each organization has a slightly different approach to solving the problems of tape recording. Scientists and engineers are human, as well, and have been known to disagree, sometimes violently about what ways are best. Advances in the manufacture of tape, improvements in head design, and the lowering of electronic circuit costs have made bizarre solutions quickly change into practical realities. The optimums have shifted and will probably continue to do so. Standards are set by man, not cast in stone. But while the scientists are boxing in the conference room, we would like to be recording, so TASCAM has selected the IEC standard for record/reproduce EQ as the recommendation for the 58.

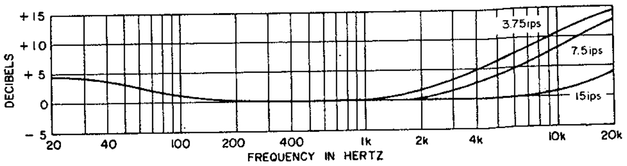


Fig. 6-9. Typical recording (pre-equalization) for 1/4-inch tape recorders using NAB characteristics.

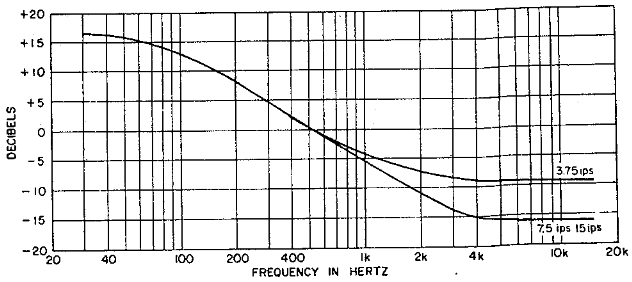


Fig. 6-10. Typical post-equalization for 1/4-inch tape recorders using NAB characteristics.

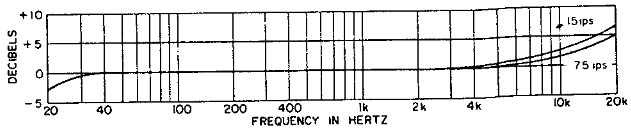


Fig. 6-11. Typical pre-equalization characteristics for 1/4-inch tape recorders running at 7.5 and 15 ips using the CCIR (DIN) standard.

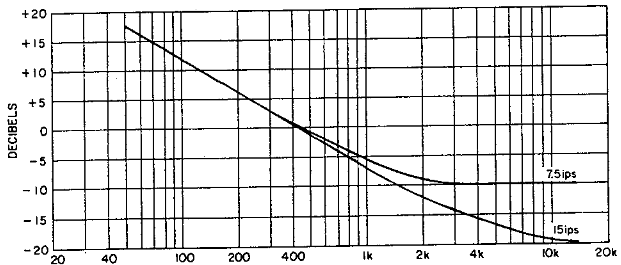


Fig. 6-12. **Typical post-equalization curves for 1/4-inch recorders using CCIR characteristics at 7.5 and 15 ips.**

Since these Reference Standard tapes cost about 3 times the price of a big roll of the best blank tape, plan on storing them carefully in a place that will not encounter any magnetic fields that might damage them – away from loudspeakers, guitar pickup, tape recorder and record player motors, power amplifiers (magnetic field surges in big transformers when amps are turned on and off can be very powerful) or anything magnetic that might alter the quality of the reference standard. If you don't damage them physically or magnetically (don't play them on dirty or magnetized recorders, or loan them out to the careless) they will last for several years. If it is not possible to obtain a tape that has both the IEC EQ and a fluxivity of 250 nWb/m, select the IEC EQ as the preferred single standard. A different reference fluxivity requires only that you make a level correction once. Just use a different mark on the meter instead of "zero." A different EQ curve requires a different amount of correction for each frequency and is much harder to use – especially for a beginner.

Level corrections for different reference fluxivity:

		Use this instead of "0" VU
15 ips	185 nWb/m – (Ampex operating level)	-3 VU
	200 nWb/m – (STL, MRL)	-2 VU

Below are tabulated some commonly encountered flux levels along with their dB differences, and their differences in dB from 185 nWb/m.

	Flux Level nWb/m	Flux Level Difference in dB	Difference from 185 nWb/m in dB
	150		1.82
	160	0.56	1.26
	170	0.53	0.73
	180	0.50	0.24
Ampex operating level	185	0.24	0.00
	190	0.23	0.23
	200	0.45	0.68
	210	0.42	1.10
	220	0.40	1.51
	230	0.39	1.89
	240	0.37	2.26
	250	0.35	2.62
	260	0.34	2.96
3 dB above Ampex operating level	261.32	0.04	3.00
	270	0.28	3.28
	280	0.32	3.60
	290	0.30	3.90
	300	0.29	4.20
	310	0.28	4.48
DIN Standard	320	0.28	4.76
	330	0.27	5.03
	340	0.26	5.29
	350	0.25	5.54
	360	0.24	5.78
6 dB above Ampex operating level	369.12	0.22	6.00
	370	0.02	6.02
	380	0.23	6.25
	390	0.23	6.48
	400	0.22	6.70

Table 6-1.

Note:
Add 0.7 dB for European measurement method using Magnetometer.

NAB Correction Chart (illus.)

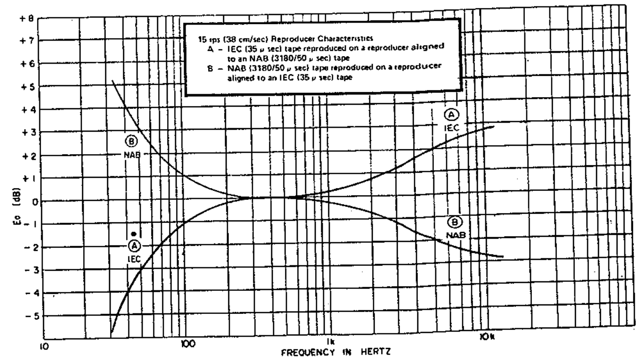


Fig. 6-13.

If you must use NAB EQ tapes, these amounts of reading are correct. NAB has more boost in playback, the tape will read progressively lower as frequencies rise when played on an IEC adjusted recorder. At 250 nWb/m reference, read these numbers to set NAB EQ.

31.5	50	125	400	1K	3K	6.3K	8K	10K	16K	18K	20K
+5.4	+3.0	+0.6	0	-0.2	-1.2	-2.3	-2.6	-2.7	-2.9	-3.0	-3.0 dB

See "Test Tapes for the 58" on page 6-8.
On to the next piece of test equipment.

2. VTVM OR FET MULTIMETER

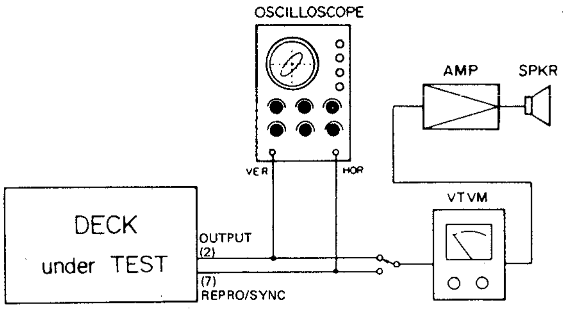


Fig. 6-14. Head Alignment Fine Adjustment Set-up and Test Connections (REPRODUCE)

Use a VTVM or FET multimeter with an input impedance of at least 1 megohm that can read levels down to -80 (full scale). You can think of this as a very accurate VU meter of very wide range. Meters with lower input impedances will draw power from the circuits to be measured and will affect the readings. Meters that have adequate input impedance but do not read below -40 (.01 V) can be used for reference levels and frequency response measurements, but will not be capable of making signal-to-noise, erase efficiency or bias circuit measurements where the output of the circuit being adjusted is expected to be very low.
Meter MUST have wide, flat frequency response (minimum = 10 Hz – 1 MHz).
This tool is not cheap and is just as important as the test tapes. Without a good reference meter, you can do very little in the way of accurate adjustment. Spend as much as you can here. It's worth it. Next . . . .

3. SIGNAL GENERATOR OR OSCILLATOR

Here you get a break. A simple oscillator will do all the work and won't send you to the poor house. There are several on the market for around $100. The local electronic surplus store can be a good source for test equipment that can be re-calibrated by the manufacturer for a reasonable cost. If you get one with a meter on it, you won't have to calibrate its output with the big meter as often. This device is very useful in a studio for troubleshooting a good investment. It should have at least the following frequencies.

40Hz – 100Hz – 400Hz – 1kHz – 4kHz – 10 kHz – 15 kHz – 18 kHz

Sine wave is all that is required, at a distortion of no more than 0.5 %. Most modern units do better than this easily. This unit is the workhorse on the equipment list. Whether you are reading the big meter (FET) or the meters on the recorder, you will need a signal to read, this instrument or the test tapes will provide you with signals.
Test tapes, tone generator, VTVM or FET meter . . . This is the basic package and will do almost every adjustment in the sequence – except the first one . . .

4. THE OSCILLOSCOPE

Even a simple one is not cheap. Fortunately, a simple one is all you need. You can spend $6,000 and more for the big ones, but for this purpose $100 – $200 will be more than enough. It must have a "vertical" and a "horizontal" amplifier and an X–Y mode. That's all you use to do the one adjustment you need it for. Tilt, height and tangency adjustments on the 58 are virtually unnecessary. The precision head block mounting plate practically guarantees long term accuracy in these areas. Only major physical force will disturb the relationship of the head block to the tape path. As long as you don't drop the recorder "face down" or strike the head assembly with a hammer all should be well. A small azimuth adjustment (±0.5 degrees) is provided for fine tuning. This adjustment is accomplished by applying screw thread pressure to a slot in the base of the head itself (See Fig. 6-15, Pg 6-7.)
Assuming that the motors are not in need of attention (that's for Dealer Service), Azimuth, or head alignment is the number one step in maintenance . . . so let's begin.

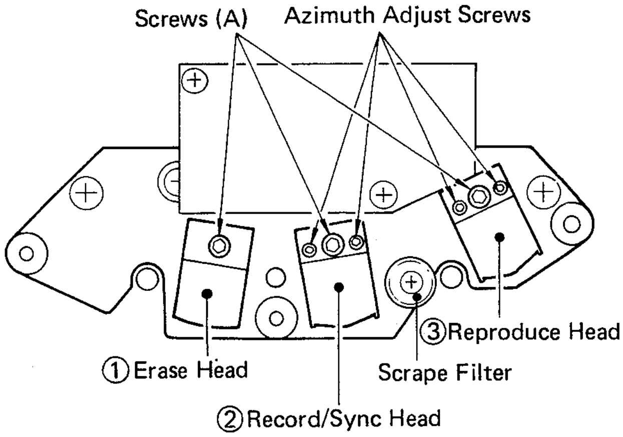


Fig. 6-15. Head Adjustment Screws and Alignment

The gaps in the heads that do the erasing, recording, and playing back must be precisely perpendicular to the tape. PRECISELY. Even a tiny error in alignment will make problems for the recorder. If the heads are not in alignment, both with the tape, and with respect to each other, tones recorded on one head will not play properly on the other. In the table below, the error is shown with the loss in dB for 1K and 10K. The amount of tilt is given in the fractions of a single degree called minutes, 60 minutes to a degree. As you can see, it only takes 1/4 degree to cause big trouble.

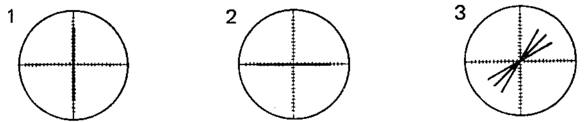
1-Mil Wavelength		1/2-Mil Wavelength		1/4-Mil Wavelength	
Loss in dB	Azimuth Error in Minutes	Loss in dB	Azimuth Error in Minutes	Loss in dB	Azimuth Error in Minutes
0.5 dB	14.86	0.5 dB	7.43	0.5 dB	3.71
1.0 dB	20.90	1.0 dB	10.45	1.0 dB	5.22
2.0 dB	29.21	2.0 dB	14.60	2.0 dB	7.30
3.0 dB		3.0 dB	17.67	3.0 dB	8.83
4.0 dB		4.0 dB	20.16	4.0 dB	10.08
5.0 dB		5.0 dB	22.16	5.0 dB	11.13
6.0 dB		6.0 dB	24.08	6.0 dB	12.04
7.0 dB		7.0 dB	25.68	7.0 dB	12.84
8.0 dB		8.0 dB	27.09	8.0 dB	13.54
9.0 dB		9.0 dB	28.36	9.0 dB	14.18
10.0 dB		10.0 dB	29.50	10.0 dB	14.75

Table 6-2. Loss due to azimuth misalignment for 43-mil quartertrack. (Courtesy, Ampex Corp. Test Tape Laboratory)

Since the 58 can use a single head (head ② in the stack) to perform all functions (recording, sync play and playback) it won't hurt the recorder to use the "whizbang studio alignment" procedure, which is to do nothing about alignment at all. You won't notice anything wrong with the sound you make, but there are drawbacks.

1. Your tapes won't play properly on any other recorder (whizbang standards are unique).
2. No accurate tune-up of the recorder will be possible, as most test procedures use one head as a reference for the other. To do this, they must be aligned perfectly.

Thread the 15 ips test tape on the recorder and find the operating level section of the tape. Connect the outputs for tracks 2 and 7 of the recorder to the 2 inputs of an oscilloscope, track 2 to the vertical input that makes the beam draw lines up and down and 7 to the horizontal input (draws lines left to right). Set the 'scope to the "Vector" or XY mode. You will have to consult the instruction book for the scope to determine how to do this. We don't know what brand of test gear you have. Play the tone, and this is what you should see:



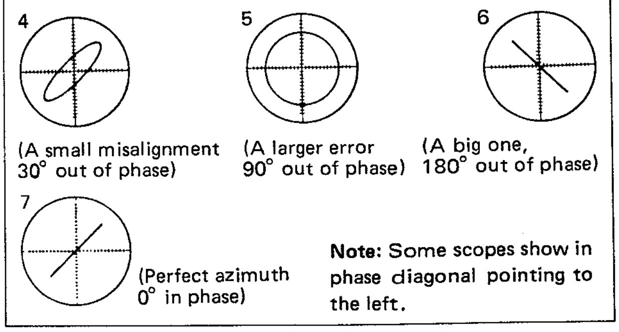
Trace for Track 2 alone

Trace for Track 7 alone

Unequal levels. One track or the other is dominant.

If the lines are not the same length for each track alone, it indicates that the 2 tracks are not putting out the same level. Adjust with the scope controls.

If the playback head is not straight up and down, you will see this kind of picture:



(A small misalignment 30° out of phase)

(A larger error 90° out of phase)

(A big one, 180° out of phase)

(Perfect azimuth 0° in phase)

Note: Some scopes show in phase diagonal pointing to the left.

Fig. 6-16. Phase Shift

How much distance error is involved depends on the frequency or pitch of the tone and the speed of the tape. One "cycle" per second at 15 ips would be hard to misalign. To get scope picture No. 6, you would have to separate the gaps in the playback head by 7-1/2 inches, but one cycle per second is not audio. How about 1,000 cycles per second of tape travel? At 15 ips, the separation or tilt in the head for scope picture No. 6 becomes .0075 inch. And at 15,000 Hz at 15 ips it's .0005 inch. Not much tilt will produce a big error. Slower tape speeds mean even smaller spacings and good azimuth becomes even more important. The proper method of adjustment is to look first at a long wave, say 1000 cycles, and make a coarse adjustment. Then work up in frequency, adjusting shorter and shorter wavelengths smaller and smaller amounts. If you start adjusting with 10 kHz or 15 kHz, you can make a big mistake. Here's why . . . Since the very short wavelengths are very close together on the tape, it is possible to get a good "picture" on the scope by adjusting one full cycle off. If you work up to 15 K, checking and adjusting as you go, you will avoid this mistake.

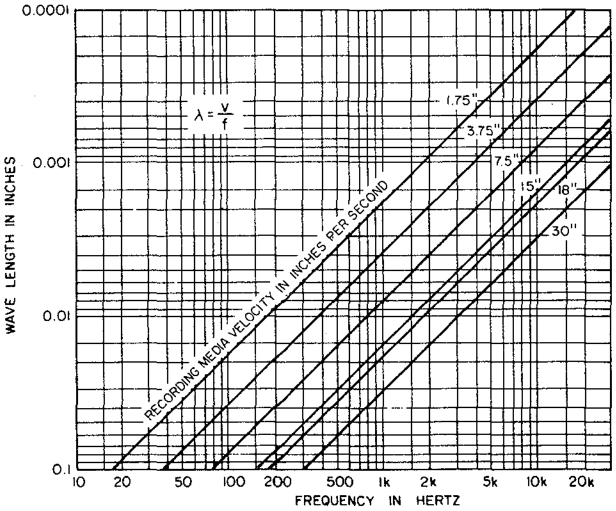


Fig. 6-17. Velocity of recording media versus recorded wavelength in inches for a given frequency.

Once you have everything set up — the reference tape is playing, the scope is running and showing the x-y display, you need a Hex Wrench and this diagram to find the right adjustment point. Adjusting the screw will rotate the head very slightly.

The next step is to play all the signals from the lowest frequency to the highest on the 15 ips alignment tape — one play for each head position (②—③), and DO NOTHING. Just have a look.

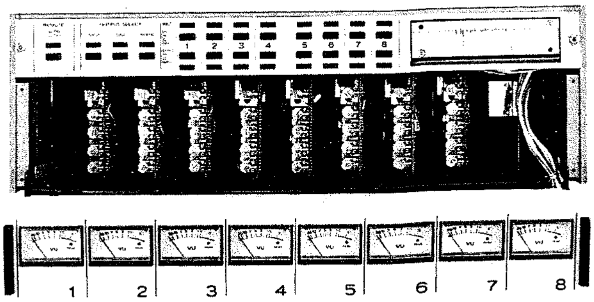
It's not a good idea to turn knobs just to "see what happens." Just because an adjustment can be made doesn't mean it's necessary. The recorder is very solid and is well adjusted at the factory, so in all test and maintenance procedures, check first, then if something is not right, adjust. Taking your time will save endless grief. A new machine is very likely to be "on the money" when you get it and if you keep it clean and degaussed will drift away from top shape very slowly. It's not necessary to plan on a major overhaul when it comes out of the box.

5. TEST TAPES FOR THE 58

TEAC YTT-1144SP (for reproduce alignment)
Tape speed: 15 ips; reference fluxivity: 250 nWb/m, equalization: IEC; time constant: ∞ + 35 μsec.
— or —
MRL31J-129 (Magnetic Reference Lab.)
All spaces are identical with YTT-1144SP except for the fringing effect and the reference fluxivity which is 200 nWb/m and thus its reproduce output level will be 2 dB lower. STL TAPE #6 - EL 3 261.3 nWb/m.

6-2. ELECTRICAL ADJUSTMENT PROCEDURE

6-2-1. Location of Electrical Adjustments



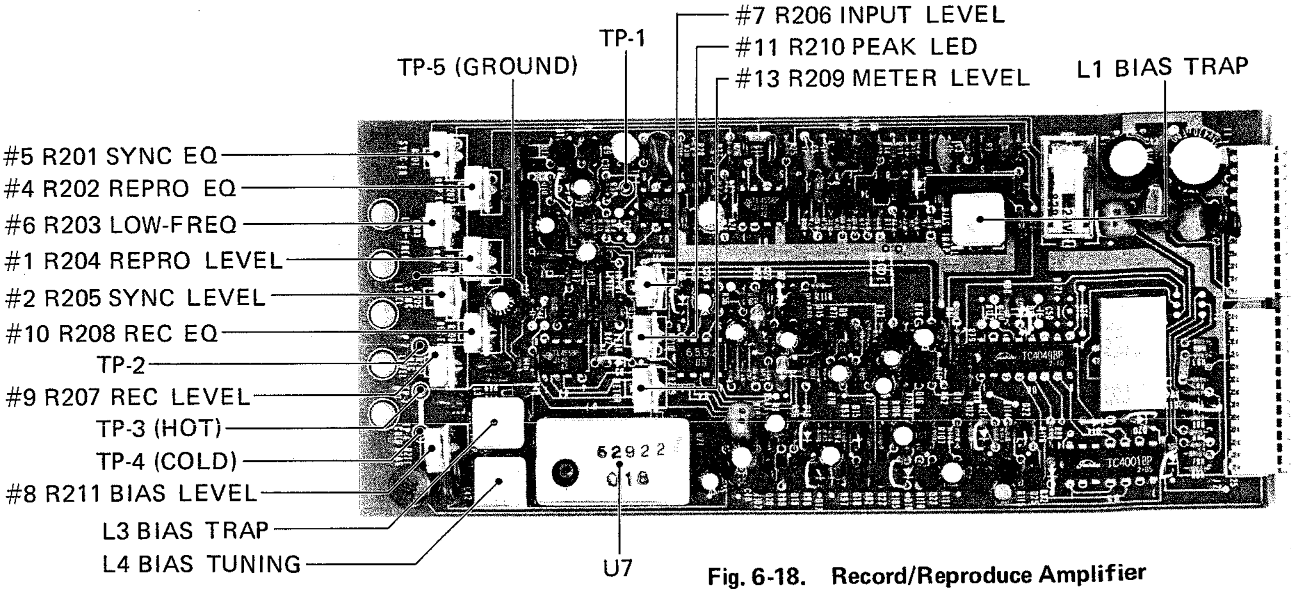

#7 R206 INPUT LEVEL
TP-1
#11 R210 PEAK LED
TP-5 (GROUND)
#13 R209 METER LEVEL
L1 BIAS TRAP
#5 R201 SYNC EQ
#4 R202 REPRO EQ
#6 R203 LOW-FREQ
#1 R204 REPRO LEVEL
#2 R205 SYNC LEVEL
#10 R208 REC EQ
TP-2
#9 R207 REC LEVEL
TP-3 (HOT)
TP-4 (COLD)
#8 R211 BIAS LEVEL
L3 BIAS TRAP
L4 BIAS TUNING
U7

Fig. 6-18. Record/Reproduce Amplifier Adjustment Positions

TRIM POT NUMBER	REFERENCE NUMBER		FUNCTION
#1	R204	5 k ohms	REPRO LEVEL
2	R205	5 k ohms	SYNC LEVEL
3	R209	50 k ohms	METER LEVEL
4	R202	2 k ohms	REPRO EQ (HIGH-FREQ)
5	R201	20 k ohms	SYNC EQ (HIGH-FREQ)
6	R203	50 k ohms	REPRO. SYNC EQ (LOW-FREQ)
7	R206	2 k ohms	INPUT LEVEL
8	R211	100 k ohms	BIAS LEVEL
9	R207	5 k ohms	REC LEVEL
10	R208	5 k ohms	REC EQ
11	R210	50 k ohms	PEAK LED
–	L1		REPRO BIAS TRAP
–	L3		RECORD BIAS TRAP
–	L4		(BIAS TUNING) CAUTION: Don't attempt any adjustments of L4 except for purposes described under the MAINTENANCE section.

Table 6.3. Reference and Function Description

6-2-2. Reproduce Adjustments

(DO NOT ATTEMPT TO CALIBRATE WITH DBX ENGAGED!)

When we're sure the playback and record heads are properly aligned, we can move on to the electronic adjustments.

The first step here is to actually check your meter calibration. To make this check, simply remove the four captive screws from both sides of the lower front panel on which the VU meters are attached. You will now have full access to each of the trim pots or inductors for adjustments of all channels.

Connect the VTVM to the output terminal of track 1. Turn the machine ON, and thread the 15 ips alignment tape. Play the "operating level" portion (a voice on the tape identifies each section at the beginning).

Switch the OUTPUT SELECT switch on the 58 to REPRO. Adjust the playback or "reproduce" level with trim pot #1, R204, 5 k ohms REPRO LEVEL so that the VTVM reads – 10 dB (0.3 V). Switch the OUTPUT SELECT switch to SYNC. Adjust the playback level with trim pot #2, R205, 5 k ohms SYNC LEVEL so that the meter reads -10 dB (0.3 V). Now read the meter on the front panel of the 58. It should read "0 VU."

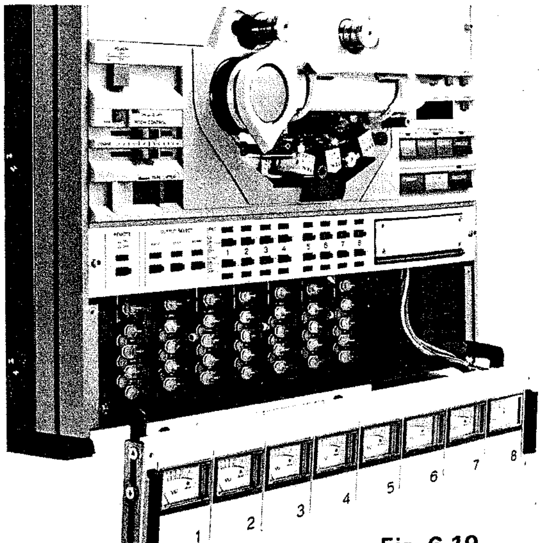
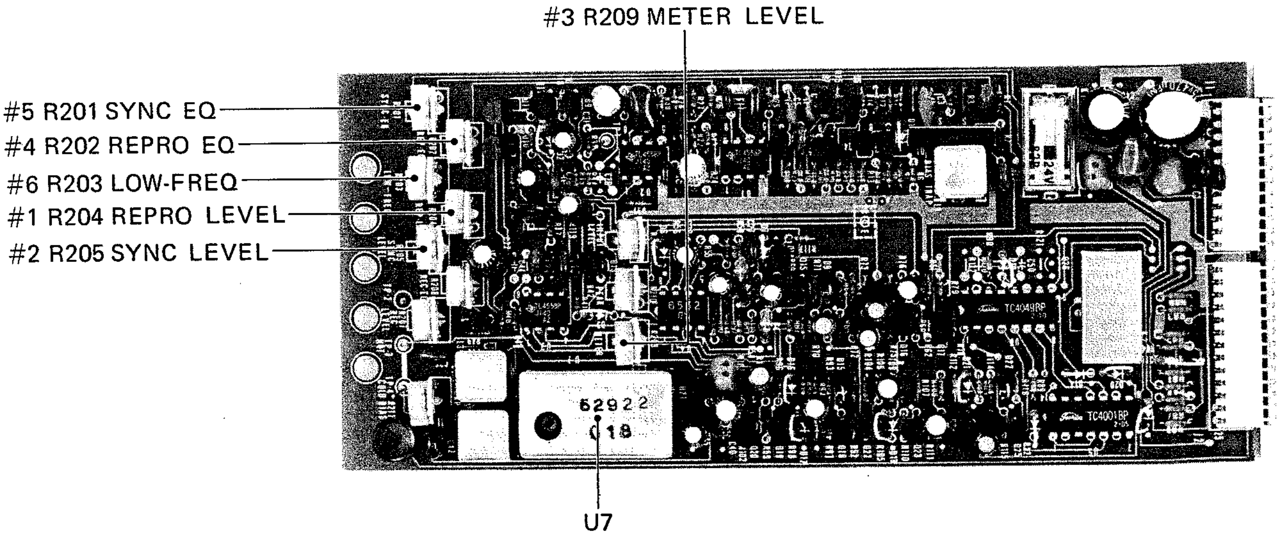


Fig. 6-19.

Adjusting trim pot #3, R209, 50 k ohms METER LEVEL will allow you to set the meter on the 58. You adjust the 58 meter to read "0 VU," not -10, the reading on the VTVM. The VU meter will read 0 at any voltage you set it for – the correct one is 0 VU. This is the right setting for the 58. You read -10 dB (0.3 V) on the VTVM and adjust the 58 meters to read 0 VU at this level.



Seven tracks still remain to be checked and adjusted, but as you can see, the adjustments are the same as for track 1. In brief:

1. Play the tape "operating level".
2. Read the VTVM for head ③, REPRO.
3. Adjust for -10 dB (0.3 V) reading with trim pot #1.
4. Switch the OUTPUT SELECT switch to SYNC.
5. Read the VTVM. Adjust trim pot #2.
6. Read the meter on the 58 — it must read 0 VU.
7. Adjust the meter trim pot #3, R209, 50 k ohms METER LEVEL.

You do this for all 8 tracks: 16 level sets and, if necessary, 8 meter trims. Don't get discouraged. When you are unfamiliar with anything, it takes more time. Practice will speed things up. The entire adjustment procedure involves reading and setting (if necessary) about 104 controls. When you are used to doing it, it should only take about an hour and a half. Have patience, you'll learn soon enough. It is absolutely worth it.

One more word of encouragement. The circuits in the 58 are very stable. Most of the time you will make a reading and not have to adjust anything. When something does go wrong, you will be able to fix it very quickly, and get back to recording.

In summary, with the VTVM and test tape you have adjusted the playback level on the 58 to the test tape. But your playback reference is not yet complete. You have only "zeroed" one point on a line of frequency response. To establish the rest of the line, you must measure and adjust one more frequency.

Advance the alignment tape for 15 ips to the section that is recorded at 18 kHz and adjust the trim pot #4, R202 2 k ohms REPRO EQ; switch the OUTPUT SELECT switch to SYNC and adjust trim pot #5, R201, 2 k ohms SYNC EQ. The reading for both positions should be 0 VU on the 58 meters. Generally, trim pot #6, R203, 50 k ohms will not necessary require adjustment except for correction of the frequency response in the lower frequency spectrum.

Since you have checked and adjusted the playback meter circuit, you can now use the meters on the 58 for test readings.

By adjusting all of the preceding trimmers, you have established two things: an operating playback level of "zero", and a playback frequency response reference. You know that both heads on the 58 are reproducing the test tape in an identical manner.

6-2-3. Record Adjustments

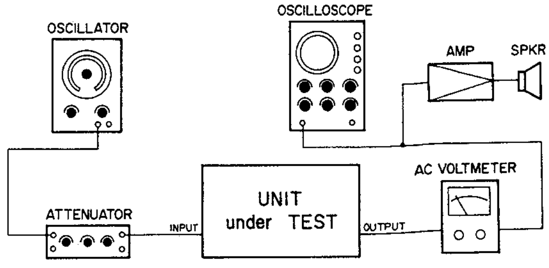


Fig. 6-20. Test Connection for Recording Check

Now you can use the repro head as a test instrument to check and adjust the record circuits. Almost all of the following steps involve recording a tone on a tape and reading the playback output of the recorder. YOU WON'T ALTER THE PLAYBACK CONTROLS. They are now all set. You will make all necessary adjustments by trimming the record electronics.

This way, you can be sure that the recordings you make, no matter what brand of tape you use (the brand of tape becomes part of the test procedure when you record your test tones on it), will playback properly on any 58.

The alignment tape can be put away. Before storing, the tape should be played all the way from front to back (not fast wound), and stored tails out, so it will last longer. Even if you decide not to attempt any major maintenance yourself, we strongly suggest you purchase an alignment tape. An occasional playing will tell you when you need to call the "doctor". It's good insurance to know the truth.

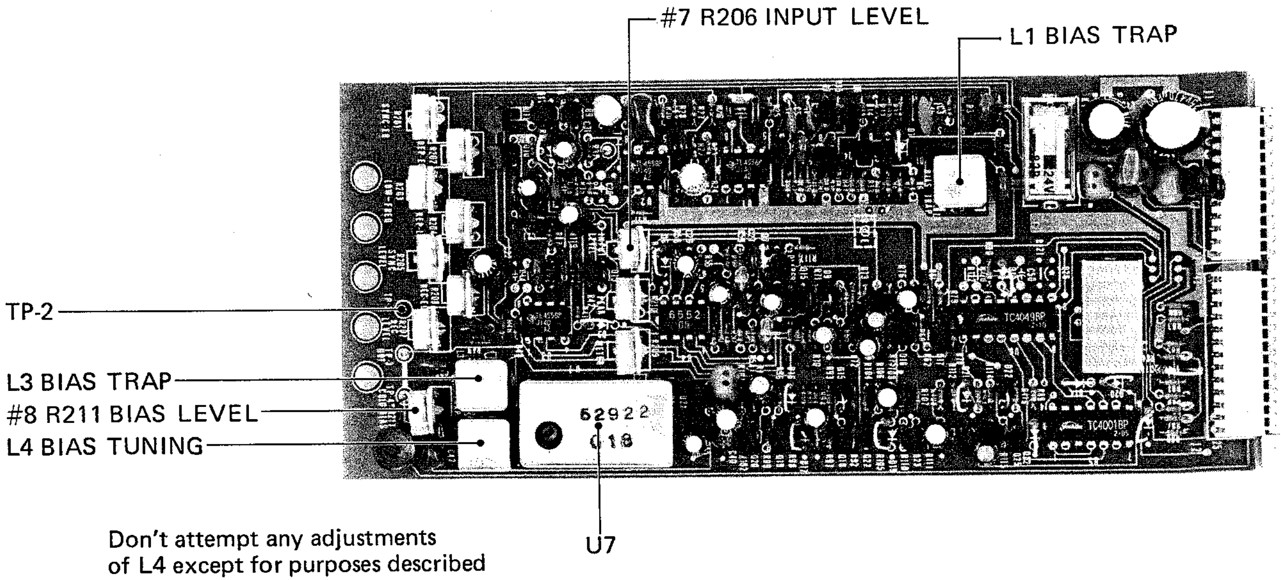
1. Input Level Adjust

Connect the reference level, or signal generator to track 1 input on the 58. The correct level is -10 dB (0.3 V).

The frequency to use is 1 kHz. It's a good idea to mark it. Check the OUTPUT SELECT switches. Make sure you have the switch marked INPUT depressed. If you get a reading, use trim pot #7, R206, 2 k ohms INPUT LEVEL and adjust the meter to read 0 VU. As always, repeat this check on all 8 tracks of the 58. Plugging and unplugging test equipment can be tedious. You can save some time by doing a reference check on your mixer. If you know that your console meter reads 0 VU accurately (check it with the VTVM), you can assign reference oscillator signals to the 58 through the mixer connections to the inputs. Assign, read, adjust: next track, assign, read adjust . . . no need to pull plugs.

2. About the Bias

At this point in the adjustment procedure we'll stop for a time and talk about a major section of the recorder electronics. The bias oscillator and its related circuitry. The bias oscillator produces a very high frequency signal that does two big jobs in the 58. It supplies the 145 kHz (one hundred forty five thousand cycles per second) frequency to the bias amplifiers in the 58. There is a bias amplifier on every card, one for each track. The bias amplifier provides power for the erase head and bias signal for the record head. Erasure is easy to explain, so we'll tackle that subject first. A lot of power is used to remove all signal from the tape just prior to its being recorded. The erase head has a rather large gap and completely cleans off any magnetic field on the tape by brute force. No new signal is recorded by this head. The gap is much too large to be effective as a recording device.



Don't attempt any adjustments of L4 except for purposes described in the "MAINTENANCE" section.

From the same amplifier, current is added to the record head circuit lead. This high frequency signal overcomes magnetic inertia in tape, and gets everything moving. If there were no "starter current" to help the record signal, we would see this kind of trouble on a scope.

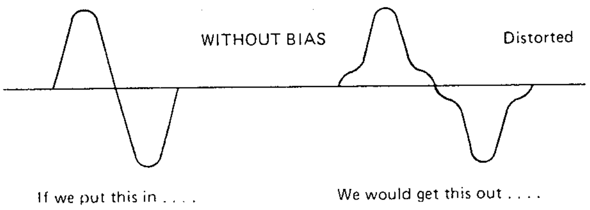


Fig. 6-21.

The beginning and ending points of the wave would be distorted by the reluctance of the iron bits to change their magnetic state from one polarity to the other. Crossing that zero line takes extra energy. The bias signal provides it. We put in this:

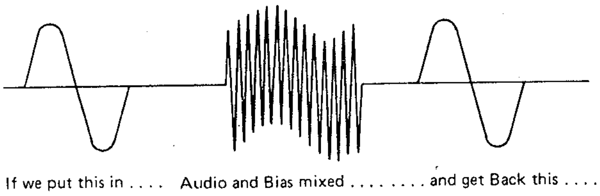

If we put this in . . . .
Audio and Bias mixed . . . .
and get Back this . . . .

Fig. 6-22.

Where did the 145 kHz go? It disappears from the output because the head gap is too large to play it back. The individual changes of magnetic energy on the tape are smaller than the gap size so a plus and a minus wave are both within the gap at the same time. They cancel out. Marvelous! On with the problems of alignment.

Well, maybe not so marvelous. Because of the fact that there is one amplifier doing 2 separate jobs. The adjustments we make on one circuit will affect the other. In fact the erase current is fixed, but there are 2 interacting circuits and life can get pretty tricky right here. The 2 adjustables are (in sequence):

1. The bias current (for the record head) trim pot #8, R211, 100 k ohms BIAS LEVEL.
2. The bias traps. Since there is a lot of power involved here, you have 2 problems. The record bias signal must not go to the record electronics, only to the head, so there is a big high frequency filter (very high, just to keep the bias out) on the wire to the record head.

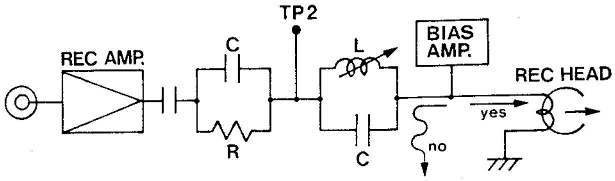


Fig. 6-23.

We've given you the bad news (they interact). Now we'll give you the good news. Unless you adjust the bias tuning coil L4 for the erase head, or the bias current by a very large amount, you won't need to check these circuits more than once every six months or so. The traps seldom need adjustment unless something is wrong with the master oscillator. The "traps" are expected to tune out the 145 kHz frequency that the bias oscillator is producing, and the range of adjustment that they have is not very good at filtering a much different frequency. If the master bias oscillator drifts, it must be re-adjusted to produce 145 kHz. Since this bias oscillator master circuit adjustment requires something expensive (very) called a frequency counter, it's wise to assume it's a dealer problem. Cart it in for this kind of service. There are also bias traps in the playback circuit to keep any stray leaks out of them as well, but they are not as touchy as the record-related circuit traps, and won't affect the load on the bias amplifier. They are tricky to adjust, but very stable. In sequence, you adjust them (if necessary) at the very end of the entire alignment procedure, so we'll mention them again.

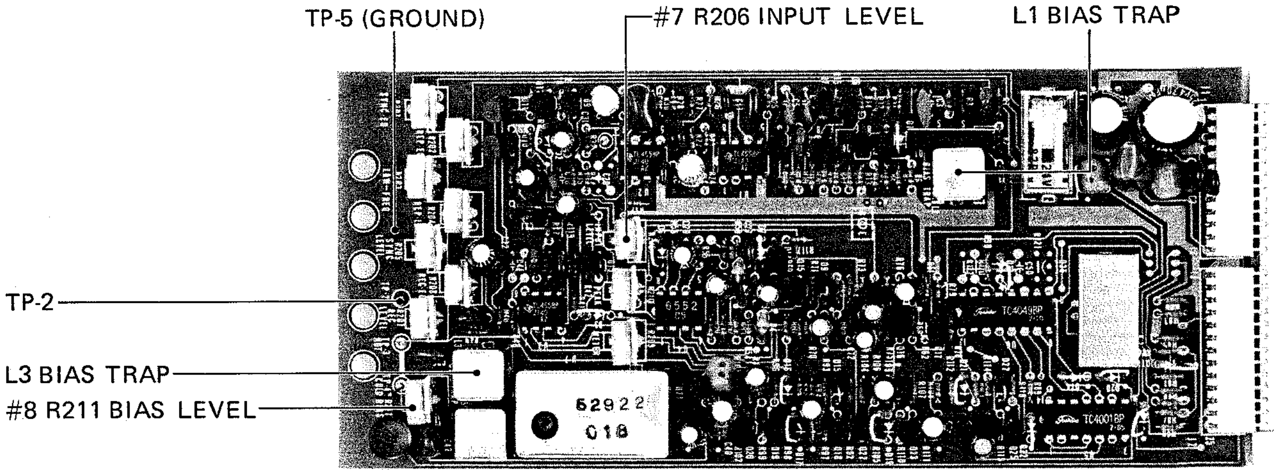
3. Bias Level Adjust

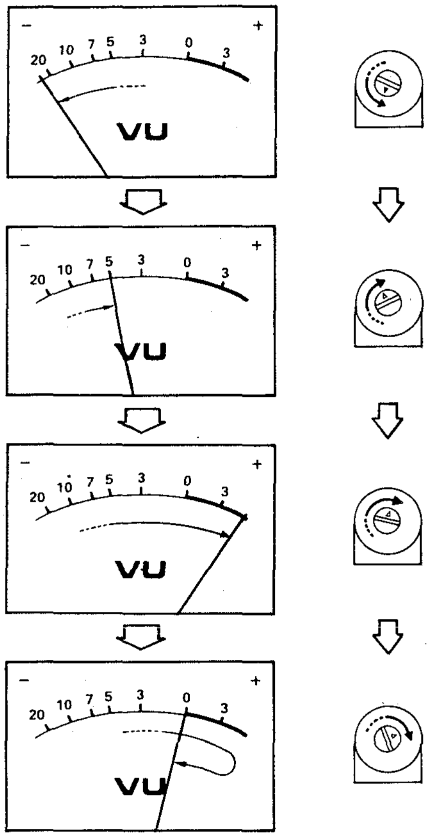
This adjustment is made while you are recording a tone on the type of tape you'll be using for the session. It will be different for each brand of tape.

Set up the signal generator (oscillator). The frequency is 10 kHz. The level should be 0 VU on the meters of the 58 on INPUT. Start the machine, record the signal, and switch the OUTPUT SELECT switch to REPRO.

Begin the adjustment by making sure trim pot #8, R211, 100 k ohms BIAS LEVEL is in the fully counterclockwise position (off, no bias at all). Now, as you rotate trim pot #8 clockwise, the VU meter will rise to some peak reading. **Continue the clockwise rotation slowly** until the reading on the meter drops back 4 – 5 dB from the peak. If, at peak, the meter goes off scale, adjust the oscillator output level to get the reading back on scale.

What is important here is not the zero. It is the reduction of the peak by precisely 4 – 5 dB. Adjust trim pot #7, R206, INPUT LEVEL when you have trouble adjusting the oscillator output level, but be sure that the input level adjustments are repeated if this trim pot is adjusted.





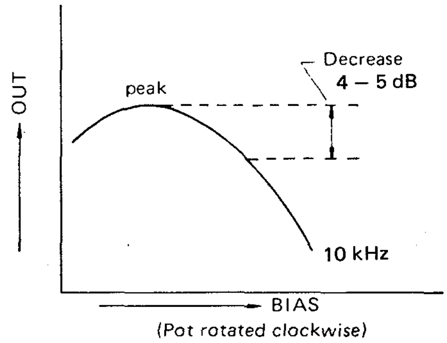


Fig. 6-24. Bias Limits Chart

If there is insufficient clockwise rotation of trim pot #8 to achieve a peak, dealer service of the bias amplifier/oscillator system will be required. Many voltages in the circuit must be adjusted accurately and this type of problem is not considered to be "routine maintenance". Bring it in.

When making bias adjustments, all 8 channels should be recording at once, even though you are adjusting only one at a time.
With the oscillator running at 1 kHz, switch the OUTPUT SELECT switch back to INPUT. Adjust trim pot #7, R206, INPUT LEVEL for 0 VU on the meters.

4. Bias Trap Adjust

Now is the time to do the bias trap in the record circuit: With no input signal, test point TP-2 is located on the PC board. Positive side of VTVM is connected to test point, negative side to ground TP-5. Tune inductor L3 for minimum.

Inductor L1 will not require adjusting except when there is an excessive amount of bias leakage noticeable at the output terminals when recording.

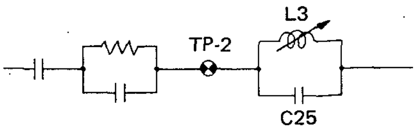


Fig. 6-25.

5. Record Level Adjust

We give these adjustments just to be accurate and thorough, and remind you again that they are seldom needed. Unless you have made some really drastic change in your recorder, you should not worry about this adjustment for at least 6 months.

Again, to be thorough, at this point it would be wise to check bias again before proceeding. On a major overhaul it might be necessary to go through these 2 steps – bias and record level adjustments – 3 or 4 times before finally moving on to the record equalization and then, once more to the end. Describing this procedure this way is probably giving the manufacturing setup, or a head replacement sequence when all values of the record circuit must be re-qualified.

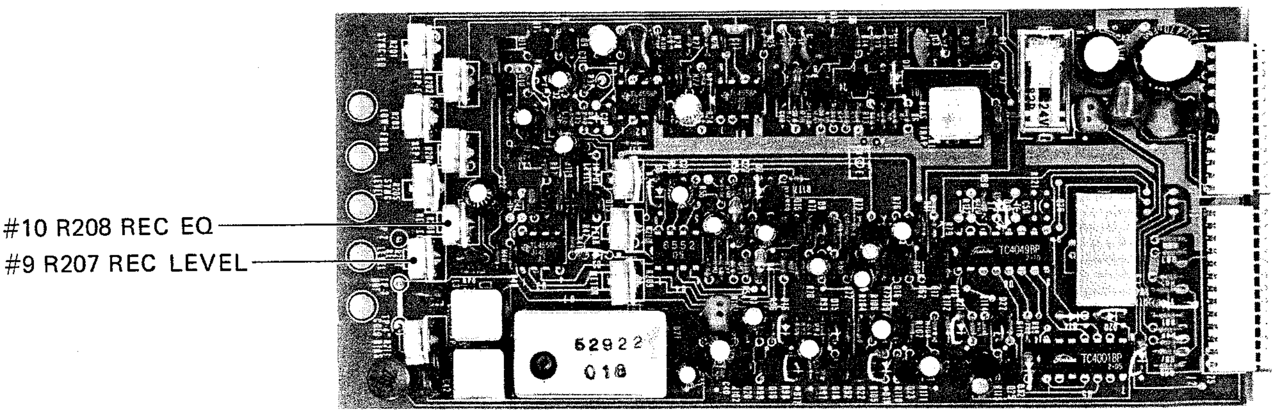
However, we do recommend that you select a brand of high quality tape and stick to it. Changing bias every day for different tapes will make the recorder cranky and a little harder to adjust. Constant messing with the controls is unwise. It is a much better idea to do as little as possible and let the recorder "settle in" to one kind.

We are now ready to adjust the record circuitry. We first check the low frequency input level at 1 kHz to get a reference. The steps are as follows:

1. Adjust oscillator to 1 kHz.
2. Switch the OUTPUT SELECT switch to INPUT.
3. Send in .316 volt, set "0 VU" on the 58 meters.
4. Record the tone at 15 ips.
5. Switch to "REPRO" and read the 58 meters.
6. With trim pot #9, R207, 5 k ohms REC LEVEL, adjust to "0 VU".

With only a few adjustments remaining in the complete procedure, let's review all you have done up to this point. Step by step, you have:

1. Cleaned and degaussed the tape path.
2. Adjust the head azimuth of both heads to 90° by checking and adjusting progressively higher and higher frequencies.
3. Checked the 58 meters against a precision meter, and set .316 volt output as "0 VU" playback.
4. Adjusted playback from both play head positions to be "0 VU" at 1 kHz and at 18 kHz, using the test tapes as an absolute reference of magnetic level.
5. Applied a reference level to the input of the 58 and adjusted the "0 VU" point to be .316 volt, both in the circuit and on the meters.



6. Set the bias level for the tape of choice.
7. If you have the equipment, make sure no bias is going to the record amplifiers.
8. If you have the equipment, set (after bias) the record "0 VU" and read it off playback. You now know that the tape you are making has the same level of magnetic flux recorded on it as the reference alignment tape, but only at 1 kHz, the basic adjustment frequency.

6. Record Equalizer Adjust

The frequency to send in is 1 kHz, record the tone at "0 VU" in, switch to REPRO and select 18 kHz. Adjust trim pot #10, R208, 5 k ohms REC EQ to read "0 VU" in playback.

If you can't seem to get a "good" reading because you run out of adjustment range, try these points.

- Re-clean the three heads.
- Re-check the bias. If the bias current is too high, the high frequency sensitivity is reduced in relation to the 1 kHz point. Check it out.

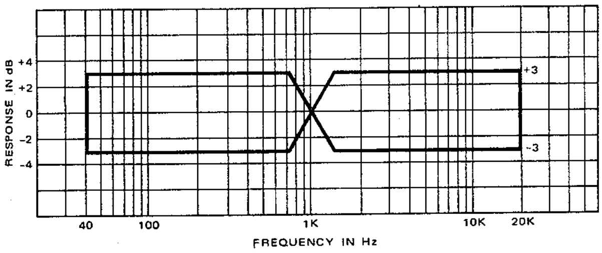


Fig. 6-26. **Overall Frequency Response**

If all this fails to produce a reading that lies within the tolerances for frequency response on this graph, it is time to replace the heads. If more equalization were added to the record circuit to overcome wear, the boost needed would be large enough to make the signal-to-noise ratio specification impossible to achieve.

Let's assume everything is OK so far. You have sent in and read back good numbers for 15 ips, everything in spec at both frequencies. Now, as a check, record everything you have on your tone generator (if it is variable, be reasonable, say 9 frequencies) 40 Hz, 100 Hz, 400 Hz, 1 kHz, 4 kHz, 10 kHz, 15 kHz, 18 kHz, 20 kHz – compare with the graph above.

Fine tuning the bias against the frequency trim pots will allow you to get a little closer to perfectly flat. It's time consuming but worthwhile. Suit yourself.

With the amplifier front panel closed you can now check the signal-to-noise ratio of the whole system. You use the big test meter. Record with no input signal and read the results. The reading should be -60 dBV or better (un-weighted).

That's it. The whole procedure for an electronic overhaul of the 58. Mechanical adjustments such as brake and holdback torque, reel height adjust and wow-and-flutter measurements must be done first, but they are major service and should not be necessary "out of the box." The transport logic control and switching system are described in "5-Theory of Operation". But digital i.c. theory is very complex and the necessary test equipment for repairs costs more than the recorder. **The maintenance section is not written as a guide to the beginner, so be advised, it may not help your understanding of the 58. It is useful only to the experienced maintenance technician.**

DAILY SETUP

It's obvious that an entire alignment procedure is not something that can be completed quickly. You don't begin a "major" ten minutes before the musicians arrive. It is not likely to be necessary every day, but what is reasonable? Most good engineers make several quick tests. If nothing is amiss, they start setting up the rest of the session with confidence. If there is a problem, they go further. Here is what they do.

1. Clean and degauss. Obvious first step.
2. After the recorder has been on for 10 minutes and is nicely warmed up, check the reproduce response with the test tape. A little trim? OK, no problem.
3. They then set up the signal generator and record several frequencies, say 100 Hz, 4 k, 10 k. Looks good? Then we can begin.
4. A very fussy engineer will take a look at the bias adjust to make sure everything is OK there as well, before he looks at the record EQ.

These several quick checks will usually uncover any serious trouble, and the idea is to work backwards up the chain of adjustments if anything shows an error. "Reproduce" is the first step in a major overhaul, and "Record EQ" is the last.

If everything works OK, you can assume all is well. If you get something funny as a reading, you will have to track it down, but these tests will usually give you some idea of where the problem lies. Work backwards through the recorder (that's forward through the adjustments, by the way, they run from back to front in the procedure, don't get confused) until you uncover the problem. You always clean and degauss, and you should always check the reproduce response with the test tape. Again, reproduce, bias, record check, no problems, OK, go, and good luck with your tapes.

Speaking of tape, we strongly suggest that you buy good quality tape and stick to one kind. While box tape is cheap for a reason. It doesn't perform as well as the "good stuff," and will be hard to tune up to, and may even damage your recorder. Excessive shedding of oxide, uneven slitting and other defects too numerous to mention will make all your efforts go for very little. Tape is important, use the best.

GENERAL ADVICE ON MAINTENANCE

Don't attempt to adjust a stone cold machine. Turn it on and let it warm up for 30 minutes.

Don't adjust the "traps" with a metal screw driver or tool. The metal tip will affect the value of the part and will give false readings. Use a plastic T.V. adjustment tool, or cut a strip of rigid plastic to size. (Credit cards will work, if you have an old one you don't need.)

Suspect any large change in adjustment that happens all at once.

Stop and think, if you turn a pot and get no change in reading, have you adjusted the wrong control?

Remove the alignment tape from the heads when switching power "on" or "off." A switching transient on a badly adjusted recorder can "print" on the tape.

Tape and electronic "hiss" should be smooth sounding. If, when recording, you detect popping, or sputtering noises, degauss the heads. If this doesn't change the sound, plan on a record bias trap adjustment.

If the oscilloscope picture is not stable when using the alignment tape (the trace opens and shuts like a mouth) suspect the holdback torque adjustment. When recording and playing test tones, suspect the tape slitting as well as the motor adjusts. If the reference tape doesn't do this, but the recording tape does, it's definitely not the recorder. It is the tape that is at fault.

At the end of a session, take the time to slow wind (spooling or play mode) the roll off the machine and store it "tails out."

Don't plan on recording over a splice. Any steady tone such as singing, or violins that you attempt to print over a cut in the tape may show a dropout, or momentary interruption. Even the best splice in the world is thicker than normal. The splicing tape adds quite a lot, and makes the tape "bump" when it goes by the head. This is especially important if you are using DBX. The dropout will be made much more noticeable by the action of the DBX.

It is a good idea to pad your master tapes by winding some blank tape on both ends, and adding leader tape.

Put a test tone (1 kHz) on each tape for reference level checks. Then it's easier to set up machines and mixers when recording sessions occur on different dates or different machines.

Keep a TRACK SHEET. Write down what happened during the session and what went on to the tape. You might list such things as mic placement; complete/incomplete takes; brand of tape used; speed; noise reduction; comments (for example: a producer might have liked a particular bass part more than others, so you can save it and use it during overdubbing and mix-down).

Have the tools-of-the-trade handy — leader tape, razor blades, splicing tape, masking tape, grease pencils, etc.

There's another old saying around studio circles: if it's not labeled, use it. So it's a very good idea to label all tape boxes and reels. And pack a track sheet in every box.

When you're not working on a tape, it's safest to put it in its box; don't leave it on the machine where an accident could wipe out weeks of work.

SERVICE CHART

ADJUST STEP	WHAT IS IT CALLED	SIGNAL SOURCE AND AMOUNT	WHAT TEST GEAR TO USE	WHAT IS THE RECORDER DOING?	POINT TO ADJUST	WHAT READING TO ADJUST FOR
1	Reproduce Head Alignment	Reproduce Alignment Test Tape TEAC YTT-1144SP	VTVM and Oscilloscope with vertical and horizontal inputs connected to OUTPUT tracks 2 and 7.	OUTPUT SELECT at REPRO Reproduce at 15 ips Speed	Repro head #3 azimuth adjusting screw. See Fig. 6-15.	Adjust for maximum, output and for output of tracks 2 and 7 less than 90° out of phase. (at 10 kHz)
2	Record/Sync Head Alignment	Same as above	Same as above	OUTPUT SELECT at SYNC Reproduce at 15 ips Speed	Sync head #2 azimuth adjusting screw. See Fig. 6-15.	Same as above
3 *	Reproduce Level (head #3)	Reproduce Alignment Test Tape TEAC YTT-1144SP Reproduce 1 kHz	VTVM connected to OUTPUT terminal	OUTPUT SELECT at REPRO. Reproduce at 15 ips Speed	Trim pot #1 R204 REPRO LEVEL	-10 dB (0.3 V) on VTVM
4 *	Sync Reproduce Level (head #2)	Same as above	Same as above	OUTPUT SELECT at SYNC. Reproduce at 15 ips Speed	Trim pot #2 R205 (SYNC LEVEL)	-10 dB (0.3 V) on VTVM
5 *	Meter Adjustment	Same as above	VU Meter	Same as above	Trim pot #3 R 209 (METER)	Adjust to read 0 VU on VU meters
REPEAT STEPS MARKED WITH AN ASTERISK FOR EACH CHANNEL. THE ADJUSTMENT NUMBERS ARE THE SAME BUT THE CIRCUIT BOARD LOCATION, INPUT/OUTPUT TERMINAL NUMBERS, VU METERS, ETC., WILL BE DIFFERENT DEPENDING ON THE CHANNEL.						
6 *	Reproduce EQ (head #3)	YTT-1144SP Test Tape. Play 18 kHz signal on the tape.	VTVM connected to OUTPUT terminal or use VU meters	OUTPUT SELECT at REPRO Reproduce at 15 ips Speed	Trim pot #4 R202 (REPRO-EQ)	Adjust for same level as per 1 kHz signal.
7 *	Sync EQ (head #2)	Same as above	Same as above	OUTPUT SELECT at SYNC. Reproduce at 15 ips Speed	Trim pot #5 R201 (SYNC-EQ)	Same as above
8 *	Input Level	1 kHz signal at -10 dB from oscillator connected to LINE IN terminals	VU meters	Stop mode OUTPUT SELECT at INPUT	Trim pot #7 R206 (INPUT LEVEL)	Adjust for 0 VU on VU meters
9 *	Bias Level Adjustment	10 kHz, -10 dB oscillator signal connected to Input jacks	VTVM connected to OUTPUT jacks or use VU meters	Record signal on type of tape that will be used for actual recording. OUTPUT SELECT at REPRO	Trim pot #8 R211 (BIAS LEVEL)	While recording adjust trim pot until VU meter indication rises to peak value, than turn pot further clockwise until signal drops off by 4 — 5 VU (over-bias).
10 *	Bias Trap Adjustment	No input signal	VTVM connected to Bias Trap test point TP-2, negative lead to ground TP-5, positive lead to test point.	Record mode, no input signal	Inductor L3	Adjust inductor for minimum output at Bias Trap test point. See page 6-15.
11 *	Record Level	1 kHz signal at -10 dB (0 VU on VU meters) connected to input terminals	VTVM connected to OUTPUT jack, or use VU meters	Record on selected tape at 15 ips OUTPUT SELECT at INPUT (to set reference), then, OUTPUT SELECT at REPRO	Trim pot #9 R207	Set for -10 dB (0.3 V) at OUTPUT jacks or 0 VU on VU meters

AD-JUST STEP	WHAT IS IT CALLED	SIGNAL SOURCE AND AMOUNT	WHAT TEST GEAR TO USE	WHAT IS THE RE-CORDER DOING?	POINT TO ADJUST	WHAT READING TO ADJUST FOR
12 *	High Frequency (REC EQ)	18 kHz signal at -10 dB (0 VU on VU meters) connected to input terminals	VTVM connected to OUTPUT jack or use VU meters	Record signal on type of tape that will be used for actual recording. OUTPUT SELECT at REPRO	Trim pot #10 R208	See for -10 dB (0.3 V) at OUTPUT jacks or 0 VU on VU meters
13 *	Overall Frequency Response	40 Hz to 20 kHz signal at -10 dB connected to Input terminals	Same as above	Same as above	Check only. Adjustment done in step 12.	Check that frequency response matches limits given in Fig. 6-26.
14 *	PEAK LED	1 kHz Input signal at +2 dBV level (+12 VU on VU meters). Apply signal for short time only.	PEAK LED in VU meters	OUTPUT SELECT at INPUT	Trim pot #11, R210	Adjust until PEAK LED goes ON
15 *	Overall Signal-to-Noise Ratio	No input signal	VTVM connected to OUTPUT jacks	Record mode. OUTPUT SELECT at REPRO		Check for -60 dBV or better

7. CHECKS AND ADJUSTMENTS

7-1. PARTS LOCATION DIAGRAM

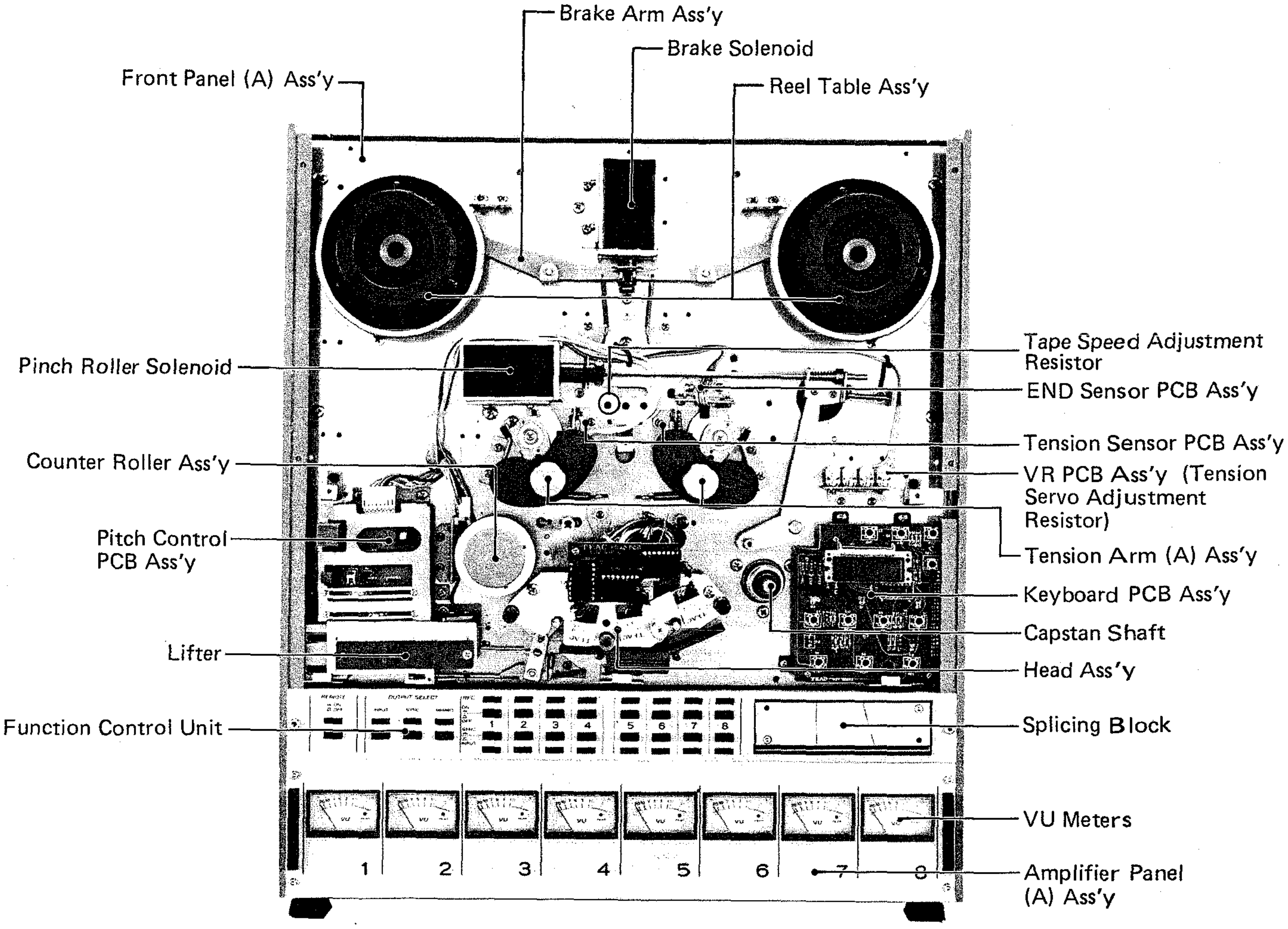

Brake Arm Ass'y
Brake Solenoid
Front Panel (A) Ass'y
Reel Table Ass'y
Tape Speed Adjustment Resistor
Pinch Roller Solenoid
END Sensor PCB Ass'y
Tension Sensor PCB Ass'y
Counter Roller Ass'y
VR PCB Ass'y (Tension Servo Adjustment Resistor)
Pitch Control PCB Ass'y
Tension Arm (A) Ass'y
Keyboard PCB Ass'y
Capstan Shaft
Lifter
Head Ass'y
Function Control Unit
Splicing Block
VU Meters
1
2
3
4
5
6
7
8
Amplifier Panel (A) Ass'y

Fig. 7-1. Front Parts Location

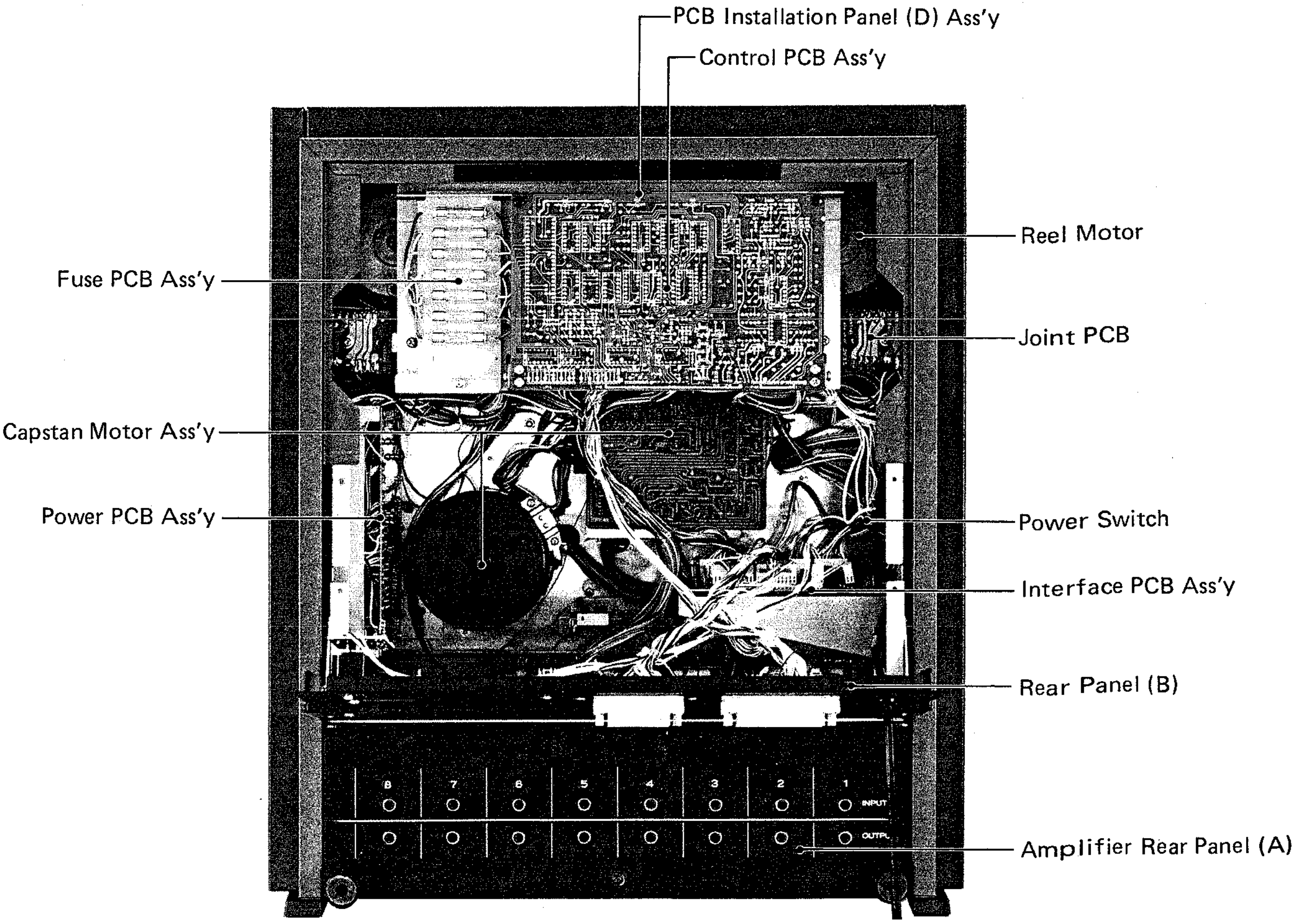

PCB Installation Panel (D) Ass'y
Control PCB Ass'y
Reel Motor
Fuse PCB Ass'y
Joint PCB
Capstan Motor Ass'y
Power PCB Ass'y
Power Switch
Interface PCB Ass'y
Rear Panel (B)
8
7
6
5
4
3
2
1
INPUT
OUTPU
Amplifier Rear Panel (A)

Fig. 7-2. Rear Parts Location

7-2. ESSENTIAL TEST EQUIPMENT REQUIRED

Wow & Flutter Meter	Meguro Denpa Sokki K.K., Model MK-668C (JAPAN), or Mincom Division, 3M Co, Model 8155 (U.S.A.)
Audio Oscillator	Hewlett Packard, Model 204C or equivalent
Digital Frequency Counter	Range: 10 Hz ~ 100 kHz; sensitivity; 0.1 Vrms; imp.: > 1 MΩ, < 25 pF
Band-Pass-Filter	1 kHz narrow band pass type
AF Level Meter	Range; -80 dB ~ +40 dB; imp.: > 1 MΩ, < 25 pF (example—HP 400GL)
Distortion Meter	General purpose (400 Hz, 1 kHz)
Oscilloscope	General purpose
Attenuator	General purpose
Tools	Spring scale: 0 ~ 8 lbs (0 ~ 4 kg) 0 ~ 2.2 lbs (0 ~ 1 kg) Hex head Allen wrenches, Plastic alignment tool
Cleaning fluid:	TEAC TZ-261 or equivalent TEAC Spindle Oil TZ-255 or equivalent
Head Demagnetizer	TEAC E-3 or equivalent
Test Tapes	Reproduce Alignment Test Tape: TEAC YTT-1144SP Equalization Standard: IEC, CCIR Time Constant: 15 ips = ∞ μs + 35 μs Wow and Flutter Test Tape: STL Test Tape 62 Blank Test Tape (Recording): TEAC Test Tape YTT-8163

7-3. — Space reserved —

7-4. REMOVAL OF THE MAIN PARTS

7-4-1. Outer Parts

A. Head housing

As shown in Fig. 7-3, the head housing can be removed by simply removing the two screws marked ⓐ in the illustration.

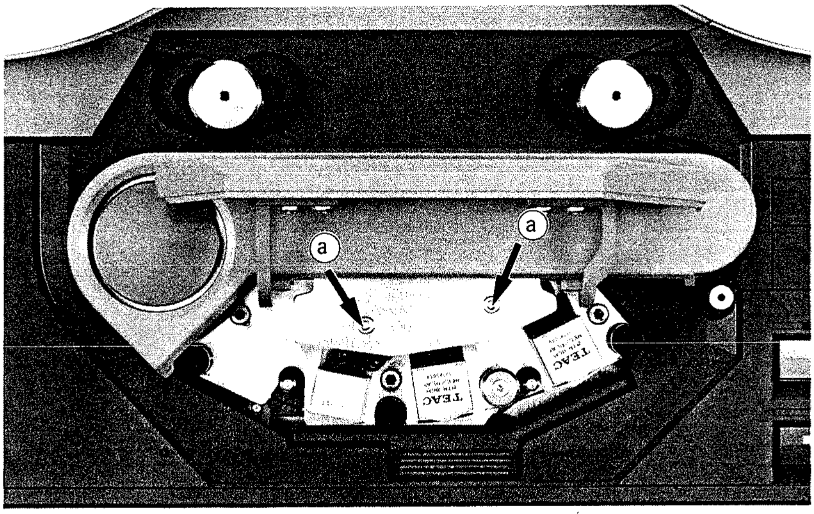


Fig. 7-3.

B. Front panel (A) ass'y

Using a 4 mm Allen wrench, remove the two Allen screws ⓐ from both the left and right sides of the front panel, and the two screws ⓑ located on the top of the deck, as shown in Fig. 7-4.

C. Dress panel (A) ass'y

1. To remove this assembly, the head housing, front panel, pinch roller and pitch control fader knobs are removed first. The pinch roller is removed by loosening the retaining screw from the top of the pinch roller.
2. Loosen the two retaining screws on the left and right sides of the function unit. Then slide the function unit back and forth to allow access to the three screws ⓒ shown in Fig. 7-4. The dress panel can be removed from the deck after these three screws are removed.

   Note: Be careful not to damage the amplifier panel.
3. Next, remove the three screws ⓓ located under the front panel.
4. After all screws have been removed, slowly pull the dress panel towards you, while taking care that the tension arm doesn't scratch the dress panel.

D. Side panels

As shown in Fig. 7-5, loosen the four retaining screws ⓐ from the feet of the deck, then remove the two screws ⓑ and the remaining six screws ⓒ to enable removal of the side panels.

E. Remaining outer panels

1. Rear panel (A) can be removed by removing the four screws ⓐ shown in Fig. 7-6.
2. To open rear panel (B), remove the two screws ⓑ located beneath rear panel (A) and the five visible screws ⓒ on rear panel (B).
3. To remove the amplifier rear panel (A), remove the three screws ⓓ located beneath rear panel (B) and the three visible screws ⓔ on the amplifier rear panel (A).

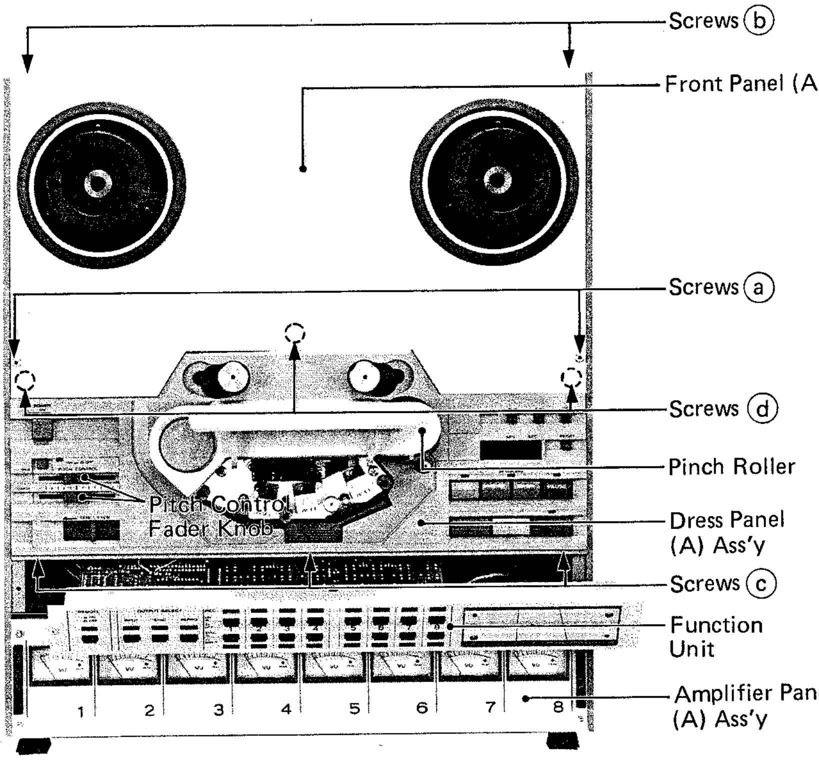

Screws ⓑ
Front Panel (A) Ass'y
Screws ⓐ
Screws ⓓ
Pinch Roller
Pitch Control
Fader Knob
Dress Panel (A) Ass'y
Screws ⓒ
Function Unit
Amplifier Panel (A) Ass'y
1
2
3
4
5
6
7
8

Fig. 7-4. Front Panels

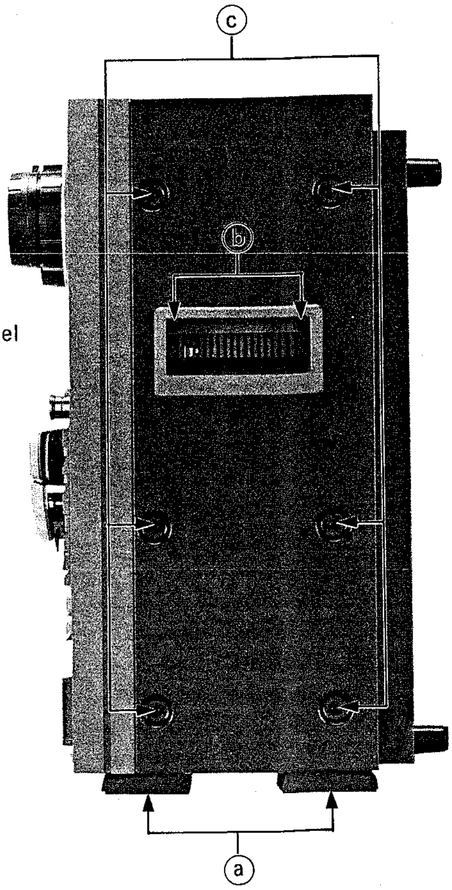


Fig. 7-5. Side Panels

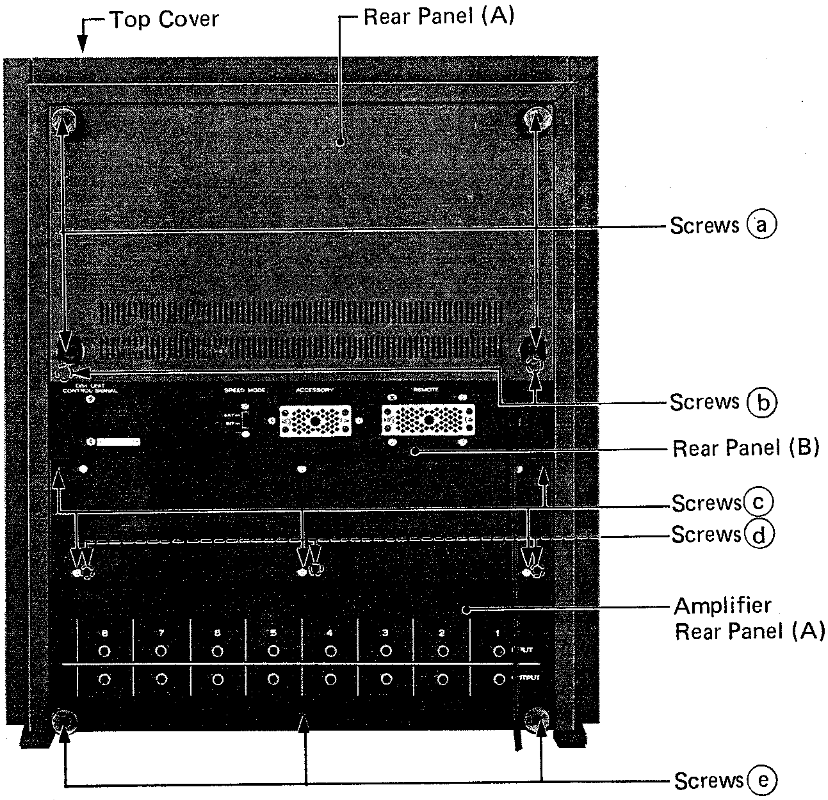

Top Cover
Rear Panel (A)
Screws ⓐ
Screws ⓑ
Rear Panel (B)
Screws ⓒ
Screws ⓓ
Amplifier Rear Panel (A)
Screws ⓔ
SPEED MODE
ACCESSORY
REMOTE
8
7
6
5
4
3
2
1
INPUT
OUTPUT

Fig. 7-6. Rear Panels

7-4-2. Head

1. First, remove the head housing as described in 7-4-1 (A).
2. Then remove the head housing mount plate (C) found behind the head housing.
3. Using a 3 mm Allen wrench, remove the three Allen screws ⓐ holding the head as shown in Fig. 7-7, and remove.
4. The head can be removed by first removing the Allen screws ⓑ located on the rear of the head and then removing the other screws ⓒ from the rear of the head base. Finally, disconnect the connectors Ⓐ from the PCB.

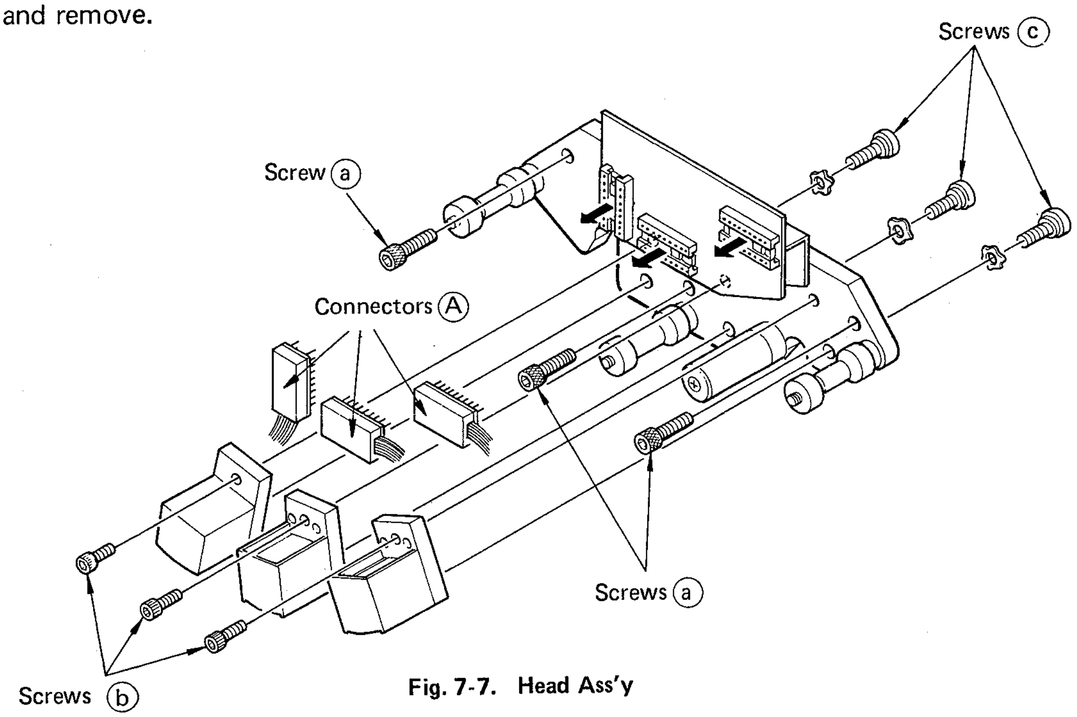


Fig. 7-7. Head Ass'y

7-4-3. Reel Motor

1. After removing the front panel as described in 7-4-1 (B), remove the PCB installation panel (D) ass'y by removing the six screws located beneath the control and fuse assemblies shown in Fig. 7-2.
2. Remove the reel table assembly and as shown in Fig. 7-8, remove the three screws holding the reel motor.
3. Finally, undo the wire running to the JOINT PCB with the use of a soldering iron.

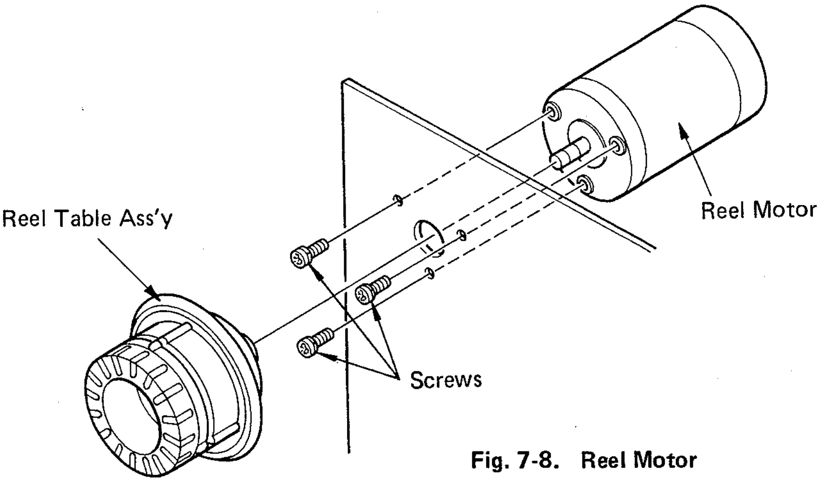


Fig. 7-8. Reel Motor

7-4-4. Capstan Motor Ass'y

1. As described in 7-4-1, remove the front panel (A) assembly, the dress panel (A) and both rear panels (A) and (B).
2. Remove the three screws ⓐ that are holding the motor section onto the capstan motor assembly as shown in Fig. 7-9. Next, remove the four screws ⓑ holding the PCB assembly and disconnect the connector to completely remove the capstan motor assembly.

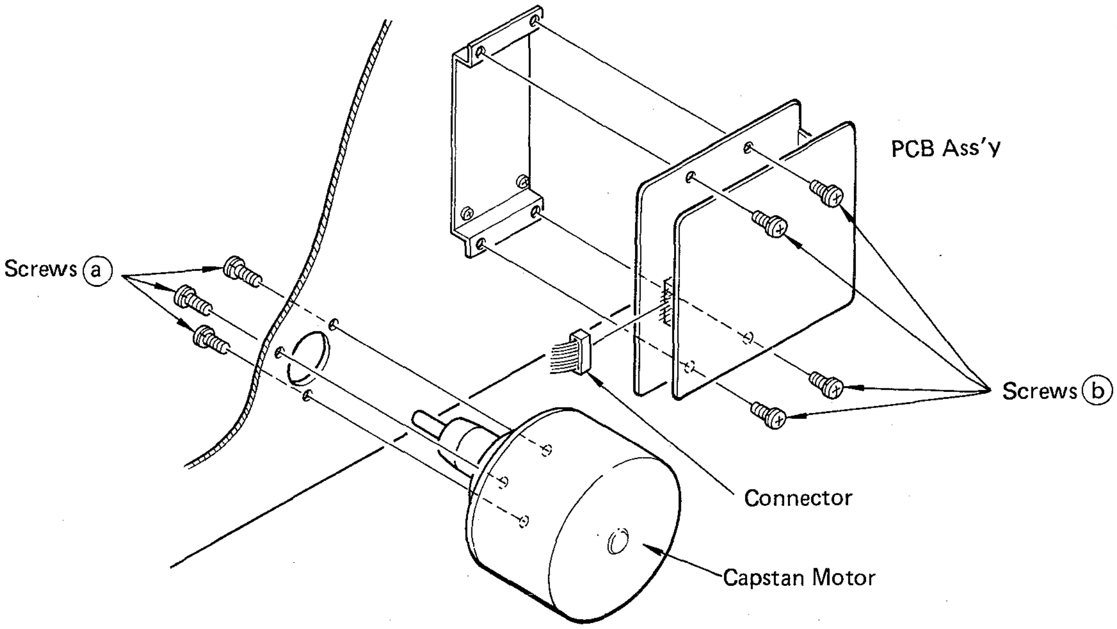

PCB Ass'y
Screws ⓐ
Screws ⓑ
Connector
Capstan Motor

Fig. 7-9. Capstan Motor Ass'y

7-4-5. Fuses

All together seven fuses will be visibly noticeable when the rear panel (A) is removed as described in 7-4-1 (E).

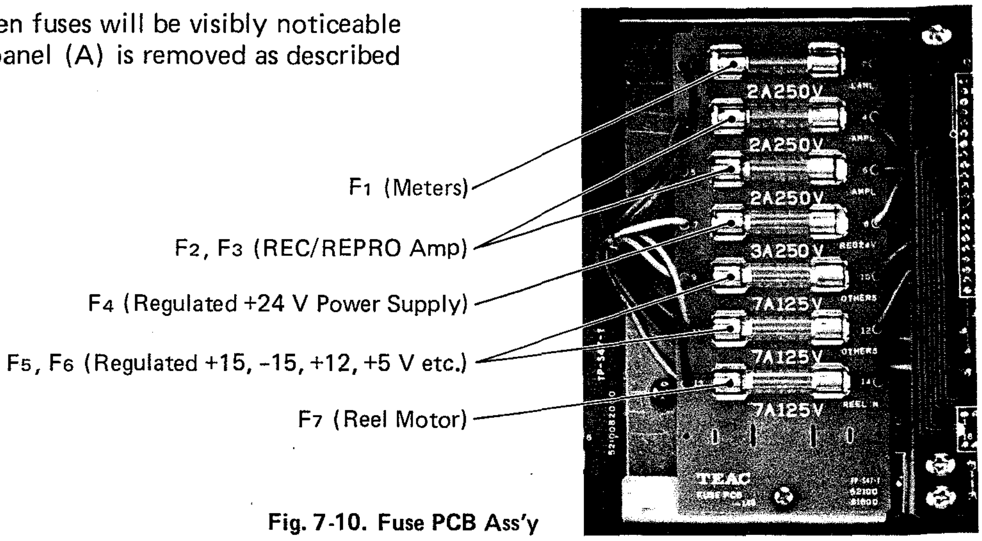

F1 (Meters)
F2, F3 (REC/REPRO Amp)
F4 (Regulated +24 V Power Supply)
F5, F6 (Regulated +15, -15, +12, +5 V etc.)
F7 (Reel Motor)
2A250V
2A250V
2A250V
3A250V
7A125V
7A125V
7A125V
TEAC

Fig. 7-10. Fuse PCB Ass'y

7-4-6. Meters

1. To remove the amplifier panel (A) assembly, remove the four retaining screws with a 3 mm Allen wrench and pull outwards.
2. Next remove the screws ⓐ from each side, and as shown in Fig. 7-11, pull the amplifier panel (A) assembly downwards.
3. Remove the six screws ⓑ from the upper and lower sides of the amplifier panel assembly (A) to remove the amplifier chassis that's holding the meters in place.
4. If necessity calls for replacement of the meters, use a soldering iron to disconnect the PCB from the meters.
   To ensure that the LED is correctly attached to the PCB, temporarily mount the LED onto the PCB, and then attach the PCB to the meters before finally soldering the terminals of the LED to the PCB.

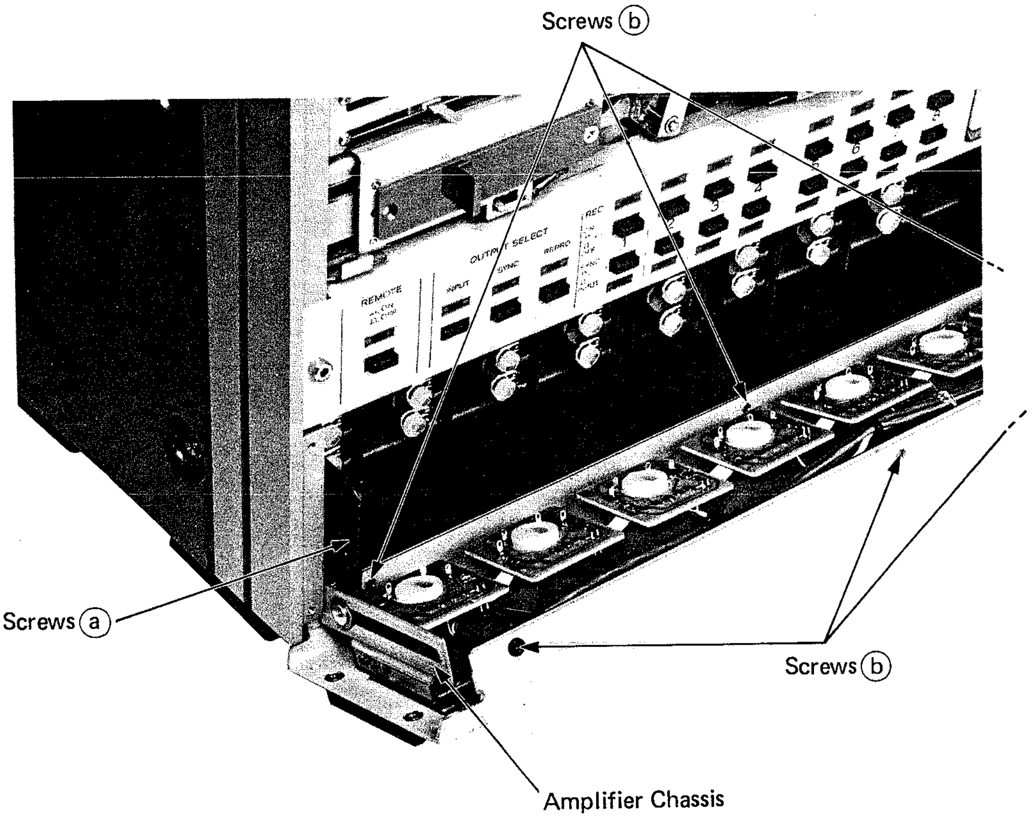

Screws ⓑ
Screws ⓐ
Screws ⓑ
Amplifier Chassis
REMOTE
OUTPUT SELECT
INPUT
SYNC
REPRO
REC

Fig. 7-11 VU Meters

7-5. TAPE TRANSPORT CHECKS AND ADJUSTMENTS

7-5-1. Brake Mechanism

Note: Be sure that the power is turned off prior to making any adjustments to the brakes.

1. Make sure that the tip (A) of the brake arm assembly does not come into contact with the upper and lower sides of the recessed part of the brake solenoid. If contact is noticeable, adjust the screws ⓐ of the hanger until tip (A) retains a centered position between the recessed part of the brake solenoid.
   Note: Take care that the brake band is not twisted in any way when making this adjustment.
2. Manually operate the brake plunger to be sure that the brake band is separated from the brake drum. Then turn the left and right reels motors by hand and check that they move freely.
   If the brake band is still making contact with the brake drum at this point, adjust the position of the brake solenoid by loosening the three screws ⓑ

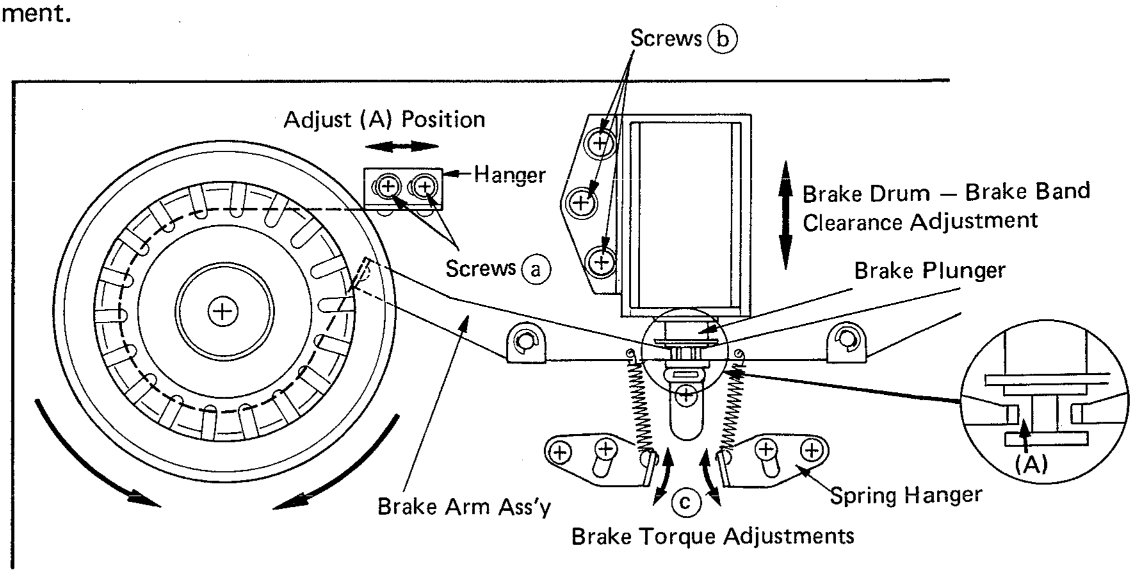


Fig. 7-12 Brake Mechanism Adjustments

7-5-2. Brake Torque

Note: Before making any brake adjustments or measurements, make sure the power is off.

1. Mount an empty 10-1/2" reel onto either reel table and attach a spring scale to the reel with a string. See Fig. 7-13.
2. Smoothly pull the scale away from the reel under test and note the torque value when the reading on the scale is steady. The proper torque values are given in the chart on the following page.
3. Follow steps 1 and 2 for each measuring condition; i.e., (D) through (A) in Fig. 7-13.
4. If the forward-direction torque is not correct, change the hooking position of the spring hanger (reference ⓒ in Fig. 7-12) for the corresponding brake requiring adjustment, if, after the forward-direction torque has been properly adjusted, the reverse-direction torque is not correct, or the forward-direction torque is still not correct, replace the brake felt pad with a new one after cleaning the inner-side of the brake belt with an alcohol cleaning solution, and also check that the brake mechanism is properly aligned as explained in Section 7-5-1. "Brake Mechanism". If necessary, replace the entire reel table.

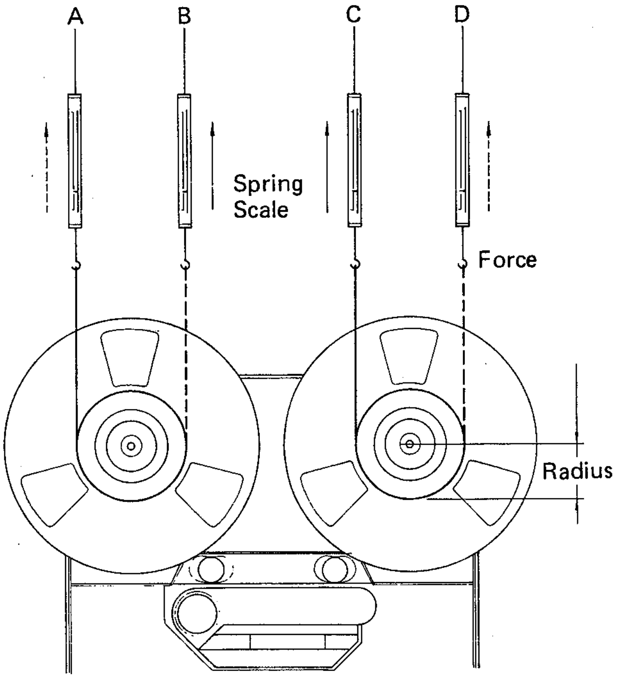


Fig. 7-13. **Brake Torque Measurement**

Forward direction (B) (C)	2300 – 2700 g-cm (31.9 – 37.0 oz-inch)
Reverse direction (A) (D) (Reference values)	900 – 1000 g-cm (12.5 – 13.9 oz-inch)
Left/Right deviation	200 g-cm (2.78 oz-inch)

Table 7-1. **Brake Torque Values**

Torque calculating formulas:

1. Torque (in g-cm or oz-inch)
   = Force or Weight (in g or oz) x Radius (in cm or inch)
2. Conversion of g-cm to oz-inch:
   g-cm x 0.0139 = oz-inch

7-5-3. Pinch Roller Pressure

Note: Pinch roller pressure is supplied by the pinch roller spring arm, and it is most important that the solenoid plunger be fully bottomed before taking pressure measurements.

1. Insert something soft or foldable between the tension arm and the opening on the front panel (A) so that the unit will be operative.
2. Replace the screw attached to the top of the pinch roller with a slightly longer one and hook the string from the spring scale onto it.
3. Place the deck in the reproduce mode without threading the tape.
4. Pull the pinch roller away from the capstan shaft (on a plane intersecting the center of the capstan shaft and the pinch roller) until the capstan shaft and the pinch roller are separated.
5. Ease pressure on the scale until the pinch roller just begins to turn. The scale should then read 1.9 kg to 2.2 kg (4.19 lbs to 4.85 lbs).
6. If you don't get this reading on the scale, adjust the brass sleeve that is controlling the pressure of the pinch roller spring by loosening the Allen screw until proper reading is obtained.

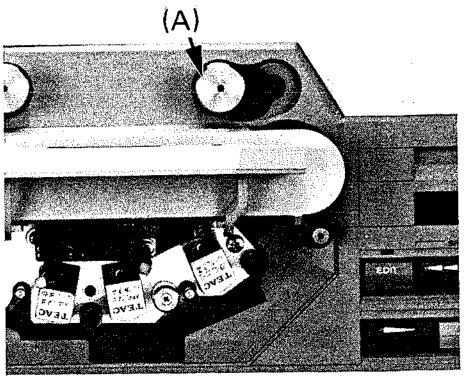


Fig. 7-14.
Right Tension Arm

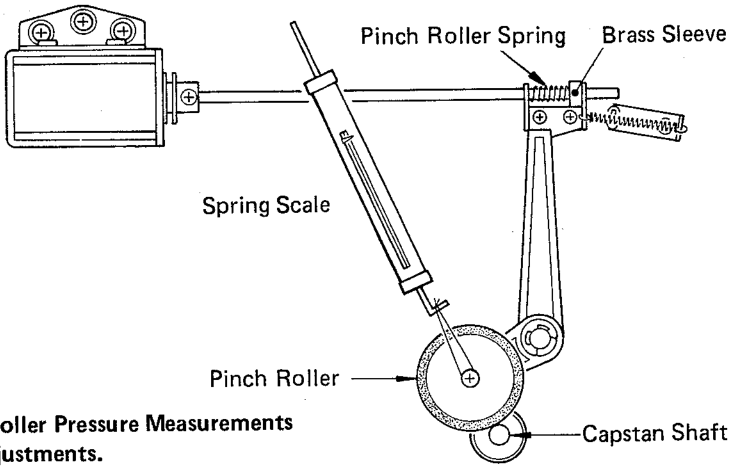


Fig. 7-15. **Pinch Roller Pressure Measurements and Adjustments.**

7-5-4. Tape Tension Servo and END Sensor

Tension Arm Positions and Detection Characteristics

The tape tension servo detects and controls the tape tension through either left or right tension sensor assemblies located under the front transport panel and each function exactly the same. The assembly includes an LED and a phototransistor with a light shield plate for the tension arm placed in between. The light shield plate varies the amount of light which strikes the phototransistor, and thereby, the movement of the tension arm is detected.

Fig. 7-16 shows the tension arm positions and its relation with the sensor. Fig. 7-17 shows the relations between the angle of the tension arm and voltage at TP-1 and TP-2 which are also illustrated in Fig. 7-21.

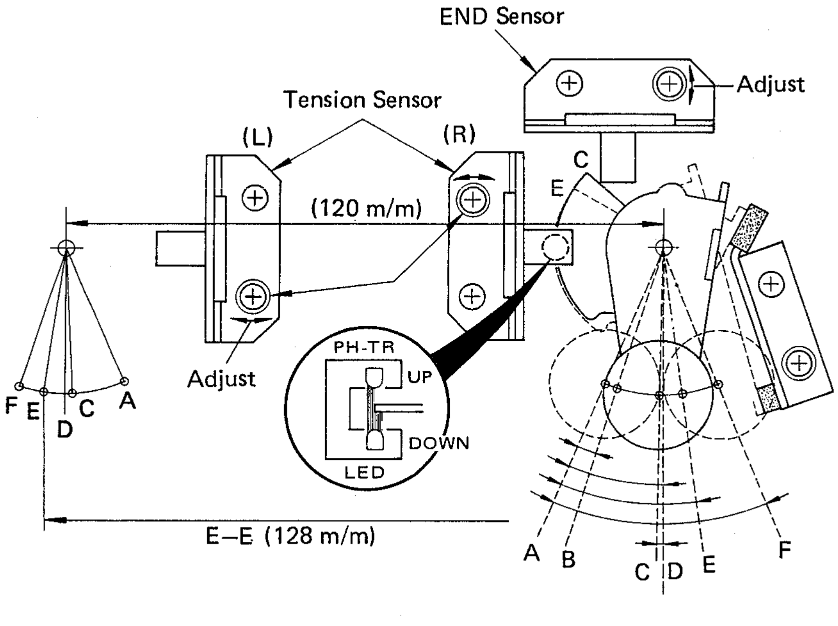


Fig. 7-16. Moving Position of Tension Arm Ass'y

A – F: Variable range of the arm
A – B: Detection range of END sensor
C : Free position (position of the arm with the deck placed vertically and no spring attached)
D : Vertical setting position (center of variable range)
C – D: Position of supply arm (BT) in the F.F. mode
E : Position of arm setting while in the play mode

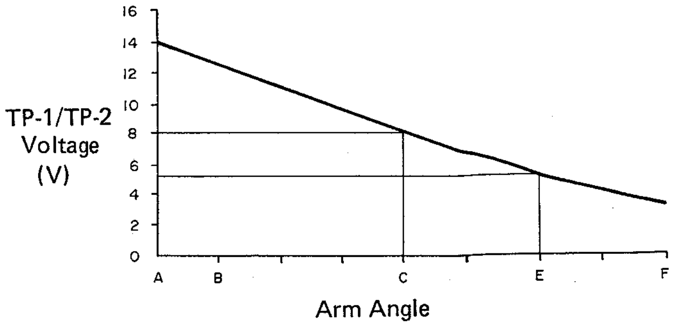


Fig. 7-17. Detection Characteristics of the Sensor

A. Position of the tension arms while in the reproduce mode.

1. Remove the front panel (A) assembly as described in 7-4-1 (B).
2. Thread a blank tape onto the deck and wind half of the tape onto the take-up reel so that there is an equal amount of tape on both reels. Then set the deck into the edit mode of operation.
3. With the deck in the edit mode, confirm that both tension arms are near the E position shown in Fig. 7-16 – about 30° from the free position C. The interval between both of the tension arms E points should be approximately 112 mm.
4. If adjustment of the interval is necessary, adjust by adjusting the trimmer resistor located on the upper part of the keyboard PCB assembly. Refer to Fig. 7-18.

   R_1: Right tension arm (Take up reel)

   R_4: Left tension arm (Supply reel)

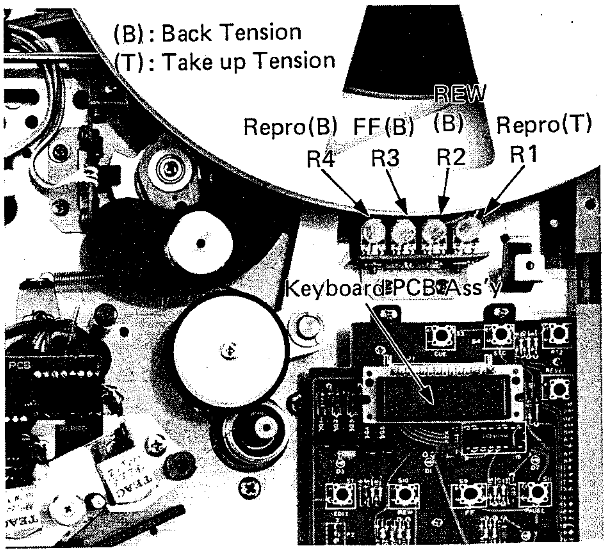

(B): Back Tension
(T): Take up Tension
REW
Repro(B)
FF(B)
(B)
Repro(T)
R4
R3
R2
R1
Keyboard PCB Ass'y

Fig. 7-18. Tension Adjustment Trimmer

B. Tape tension while in the reproduce mode.

If proper tension arm positions have been obtained as described in A, proceed with the tape tension measurements.

Thread a blank tape onto the deck in the same manner as described in A (2) and set the deck into the reproduce mode. Now, with the tape running, measure the tape tension at both the take-up side and supply reel side with a tension analyzer or a tentelo meter. The measurement should be made at both the supply side and take-up side at points A and B as shown in Fig. 7-19.

The value to be obtained is 75 – 85 g. If you can't get this reading on your analyzer, adjust the tension strength of the spring by changing the position of the spring hook: Ⓐ and Ⓑ.

Note: As 10-1/2" reels cover more area than 8" reels, we suggest that you use the smaller 8" reels to ensure sufficient working room to get at the A and B points with the tentelo meter probes.

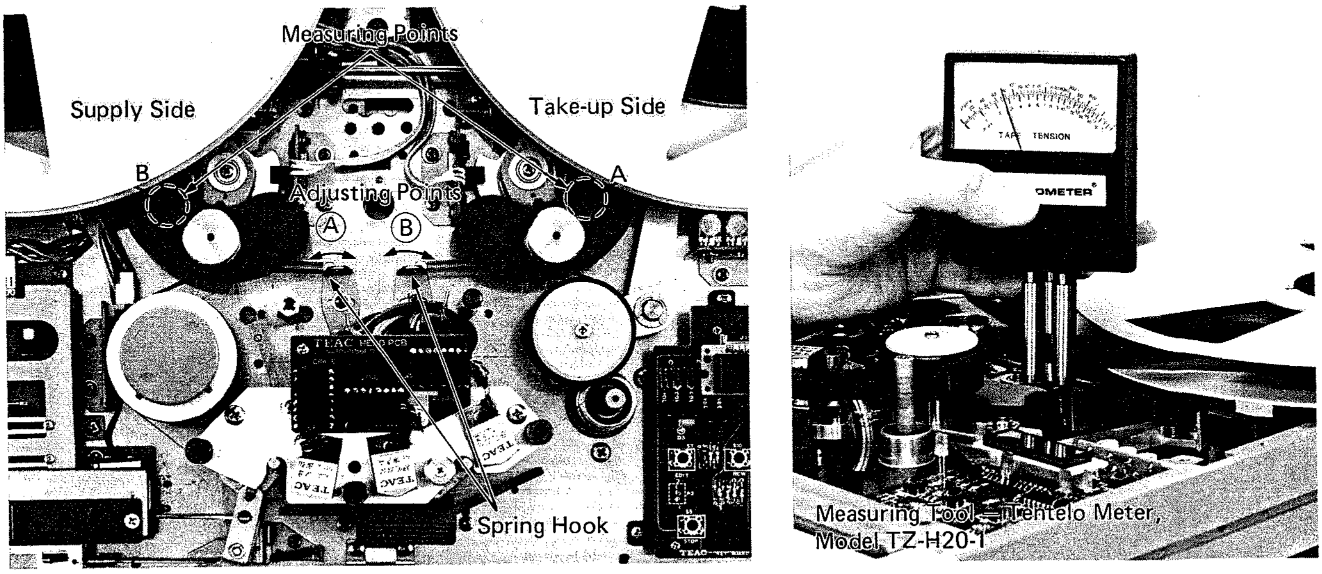

Measuring Points
Supply Side
Take-up Side
B
A
Adjusting Points
Ⓐ
Ⓑ
Spring Hook
TAPE TENSION
OMETER
Measuring Tool = Tentelo Meter, Model TZ-H20-1

Fig. 7-19. Tape Tension Measurement and Adjustment Points

C. Tape tension while in the fast forward and rewind modes.

1. Thread a tape onto the deck and set it into the fast forward or rewind mode. Begin measuring at the point where the tape speed seems to be stabilizing; the tape becomes stable when the tension arm on the take-up side drops back after initially drawing the tape upwards. Adjust R2 (rewind mode) and R3 (fast forward mode) so that the tension arm on the supply side comes to the C position shown in Fig. 7-16. If a tentelo meter is used, the following specifications should be of help.

	1/2" Tape
Fast forward, left side	60 g
Rewind, left side	180 – 200 g
Fast forward, right side	180 – 200 g
Rewind, right side	60 g

Setting the deck into the spooling mode will facilitate measurements when a tentelo meter is used.

R2: Rewind mode (point B)
R3: Fast forward mode (point A)

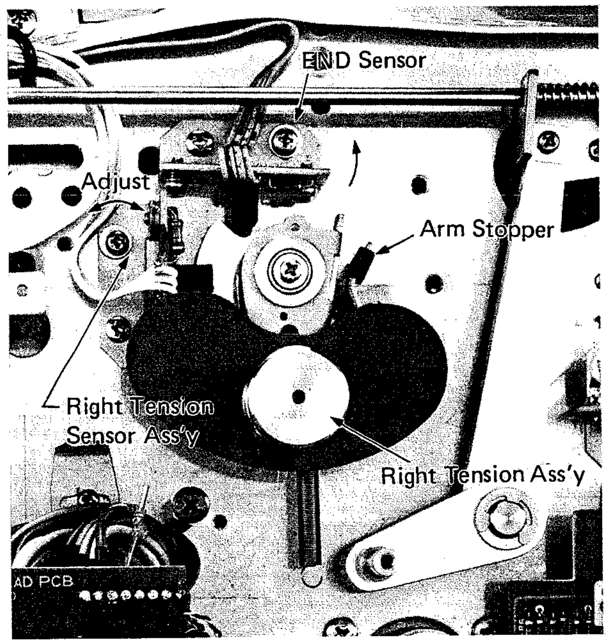


Fig. 7-20. Adjustment Positions of the Right Tension Sensor Ass'y

D. Adjustment and re-installation of the tension sensor assembly.

1. First loosen the adjustment screw on the end sensor assembly, lift the assembly upwards and temporarily secure; this will disable the end sensor.
2. Stand the deck up and remove the left and right tension springs. After which, set the deck into the edit mode without threading a tape.
3. Connect a DC voltmeter between TP-1, TP-2 and ground located on the control PCB on the rear of the deck. TP-2 can be identified by its location on the right tension arm side, while TP-1 will be located on the left tension arm side. Refer to Fig. 7-21.
4. Loosen the adjustment screw on the sensor assembly, and slide the sensor to the right and left until the voltage at TP-1 and TP-2 becomes 8 V ±0.3 V. When this value is obtained, go ahead and tighten the adjustment screw. Refer to Fig. 7-20 and 7-21.
   After the adjustment screw has been tightened, slide the two tension arms to the right and left a few times to check that the DC meter shows a linear reading of about 3 V – 14 V.
5. After these adjustments have been completed, re-attach the left and right tension springs.
   CAUTION: Be extra careful when making these adjustments because the reel motor will be rotating at maximum torque while the deck is in the edit mode.

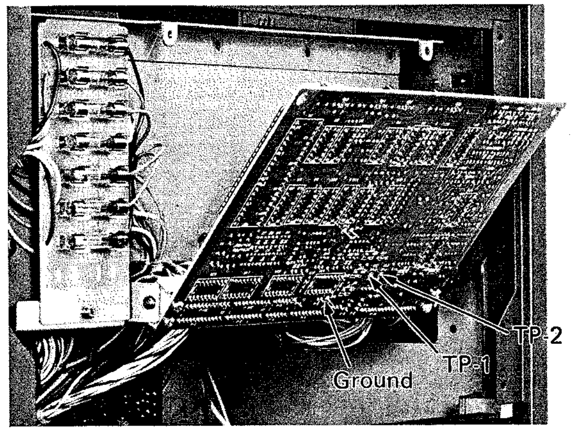


Fig. 7-21. Control PCB Ass'y

E. Adjustment and re-installation of the end sensor assembly.

1. As described in D (1), leave the sensor assembly raised to disable the end sensor function.
2. Put something of approximately 1.5 mm in thickness between the arm stopper and the right tension arm, that's point Ⓐ in Fig. 7-22. Then go ahead and set the deck into the edit mode without loading a tape.
3. Gradually move the end sensor assembly downwards, and tighten the adjustment screw at the point where the end sensor is activated.

7-7-5. Reel Panel Height

Reel height adjustment is required only if a motor has been replaced or if tape rubs excessively against the reel flanges.

Adjustment is accomplished by loosening the reel set screws and moving the reel table on the motor shaft, shown in Fig. 7-23.

Remove the front panel (A) assembly for access to the set screws in the reel motor shaft. Refer to 7-4-1 (B). The reel table should be adjusted using standard NAB 10-1/2" reels. With a tape located on the machine, position the reel table height for smooth tape travel. Be sure to tighten the set screws after each adjustment is made.

7-5-6. Tape Speed

Tape speed is measured by using Flutter Test Tape, which contains a highly accurate, continuous 3 kHz tone.

1. Connect a digital frequency counter to either OUTPUT.
2. The indicated frequency should be 3 kHz, ±0.5 % for all speeds.
3. Play the middle of the test tape and adjust the high speed trimmer resistor found near the brake solenoid after opening the front panel (A) assembly until the frequency counter indicates a reading of 3,000 Hz. The right two trimmer resistors are not used. See Fig. 7-24. (CAUTION: Use an insulated screwdriver to prevent shorting).
4. Playing the tape at both the beginning and the end, check that the tape speed does not vary any more than the limits prescribed in the specifications so that there will never be a total deviation of more than ±0.5 Hz from the 3000 Hz test tone.
5. If tape speed has greatly diverged from specification, check pinch roller pressure and take-up tension for correct values, and check to see that the tape path is clean.

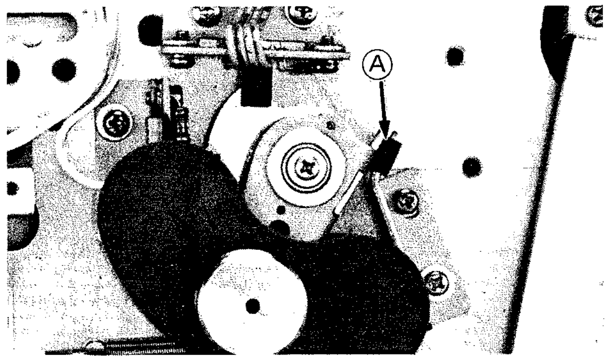


Fig. 7-22. Adjustment Position of the End Sensor Ass'y

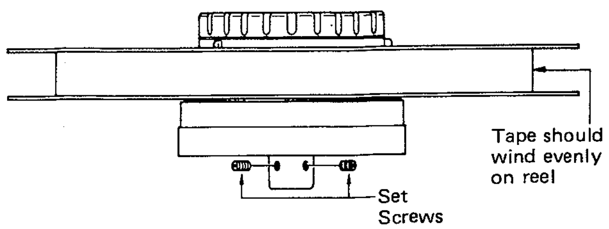


Fig. 7-23. Height of Reel Panel

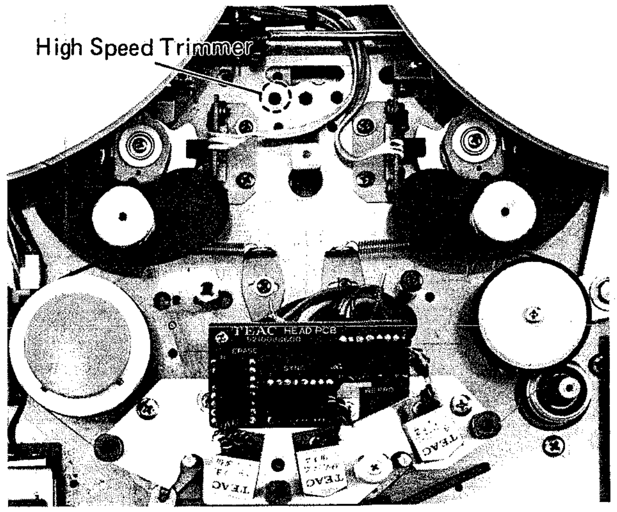


Fig. 7-24. Tape Speed Adjustment Trimmer

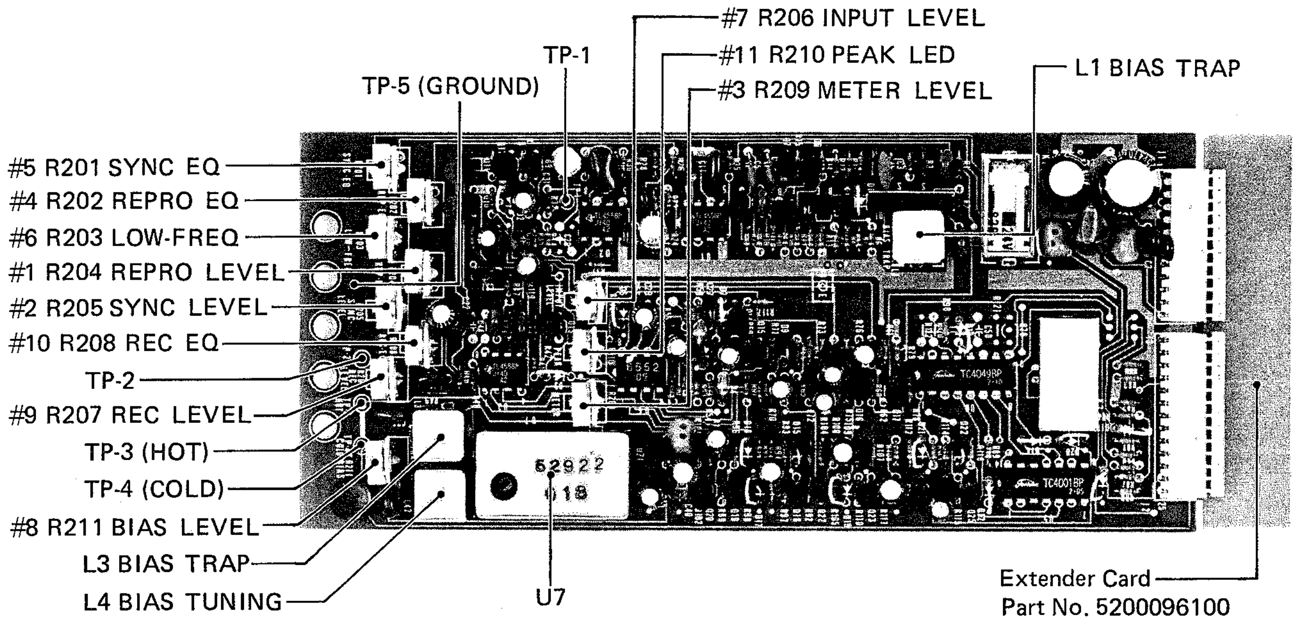
7-5-7. Wow and Flutter (Reproduce Method)

1. Connect a Wow and Flutter Meter to the OUTPUT jack on the deck.
   These meters will measure the DIN/IEC/ANSI peak value or the NAB rms value, depending on the switch selection on the meter.
2. Playback the appropriate Wow and Flutter Test Tape.
3. If the peak or rms weighted value is to be read, set the Wow and Flutter Meter for the "Weighted" readings, and also make sure that the meter is properly calibrated.
4. As the measured results may vary with respect to the location on the tape at which the measurement is taken, at least two locations – at the beginning and near the end of the tape – should be checked. There may also be slight differences in absolute values measured, depending on the brand of the meter being used.

Values should be as shown:

DIN/IEC/ANSI (peak value)		NAB (rms value)	
Weighted	Unweighted	Weighted	Unweighted
±0.08 %	±0.12 %	0.04 %	0.07 %

7-6. RECORD/REPRODUCE AMPLIFIER CHECKS AND ADJUSTMENTS


#7 R206 INPUT LEVEL
#11 R210 PEAK LED
#3 R209 METER LEVEL
TP-1
TP-5 (GROUND)
L1 BIAS TRAP
#5 R201 SYNC EQ
#4 R202 REPRO EQ
#6 R203 LOW-FREQ
#1 R204 REPRO LEVEL
#2 R205 SYNC LEVEL
#10 R208 REC EQ
TP-2
#9 R207 REC LEVEL
TP-3 (HOT)
TP-4 (COLD)
#8 R211 BIAS LEVEL
L3 BIAS TRAP
L4 BIAS TUNING
U7
Extender Card
Part No. 5200096100

Record/Reproduce Amplifier Adjustment Positions

TRIM POT NUMBER	REFERENCE NUMBER	FUNCTION
#1	R204 5 k ohms	REPRO LEVEL
2	R205 5 k ohms	SYNC LEVEL
3	R209 50 k	METER LEVEL
4	R202 2 k	REPRO EQ (HIGH-FREQ)
5	R201 20 k ohms	SYNC EQ (HIGH-FREQ)
6	R203 50 k ohms	REPRO, SYNC EQ (LOW-FREQ)
7	R206 2 k ohms	INPUT LEVEL
8	R211 100 k ohms	BIAS LEVEL
9	R207 5 k ohms	REC LEVEL
10	R208 5 k ohms	REC EQ
11	R210 50 k ohms	PEAK LED
–	L1	REPRO BIAS TRAP
–	L3	RECORD BIAS TRAP
–	L4	BIAS TUNING

Table 7-1. Reference and Function Table

7-6-1. Before Making any Checks or Adjustments

This section contains the general descriptions and cautions required for these kinds of checks and adjustments.

Before going ahead with any of the electrical performance checks or adjustments, make sure the tape transport mechanism has been completely aligned as mentioned in the preceeding section, or at least make sure that the tape path and head contact are aligned correctly as mentioned below.

A. Tape path

1. Load a tape and set the unit into the reproduce mode. Then adjust the height of the tape guide so that the tape will be traveling along the center of the three heads (ERASE, RECORD/SYNC, and REPRO).
2. The tape guide and tension roller can be adjusted by first loosening the lock screw located in the center of the upper part of both the tape guide and tension roller, and then turning the whole upper part with your fingers. A counterclockwise rotation will raise the guide and a clockwise rotation will lower the height of the guide. When proper height has been obtained, see that the lock screw is tightened again.
3. If the tape guide height is properly set, the lower edge of the tape should be just touching the lower edge of the tape guides ① and ③. As far as the upper portions are concerned, the upper edge of the tape should be just touching the upper edge of the tape guide ②. If you have problems making the adjustments in this order, you may reverse the contact positions of the edges and start over. If the height of the tension roller is properly set, the tape will be found traveling along the center of the contact head. If adjustment is required, adjust as described in A (2) earlier.

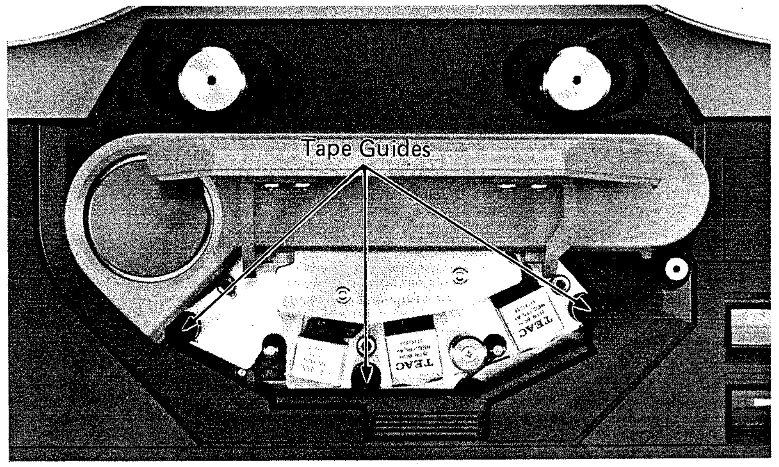

Tape Guides

Fig. 7-25. Tape Guide Adjustment Points

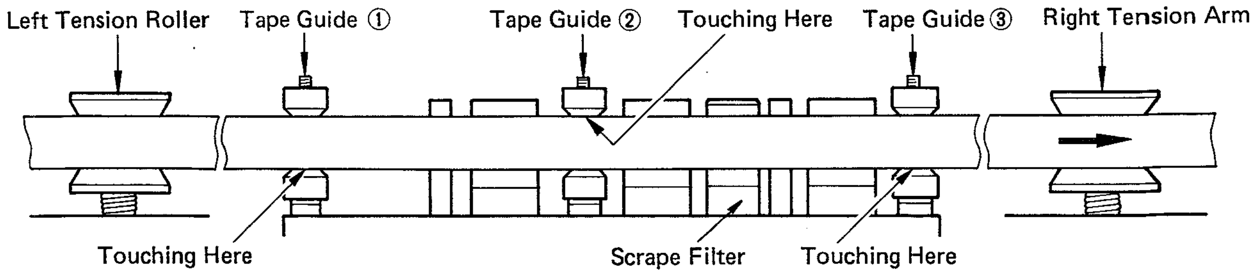

Left Tension Roller
Tape Guide ①
Tape Guide ②
Touching Here
Tape Guide ③
Right Tension Arm
Touching Here
Scrape Filter
Touching Here

Fig. 7-26. Correct Tape Travel

4. With the deck in the reproduce mode, set the tape into motion and check that the tape is traveling along the center of the head with no fluctuation in position. While you are at it, check that there is no curling of the tape at the guides or rollers.
   If you are not 100 % satisfied with the results, repeat the adjustments of the guides, etc. again.

B. Head contact
   Contact of the record/sync heads and the repro head is properly aligned by following the below methods.

1. Set the OUTPUT SELECT switch to REPRO or SYNC and load a TEAC YTT-1144SP test tape, or a prerecorded tape with a constant level tone and reproduce.
2. While observing the VU meters, temporarily increase the back tension to the left reel by lightly applying pressure by hand. If sufficient contact pressure is applied to the head while the tape is running, no change will be noticed on the meter when the back tension is increased. However, if insufficient pressure is applied to the head, the deflection needle will show increased deflection due to contact pressure caused by the back tension. This method will help determine whether head contact is properly adjusted or not. To adjust, loosen the retaining screw (A), that'll be the center screw at the rear of the head as shown in Fig. 7-27. Then, change the direction of the head for proper alignment.
   Note: The amount of pressure to be applied to the reel is very important; too strong of pressure lowers the speed of the tape, while too light of pressure does not ensure contact. However, by practicing a few times, you will be able to judge approximate pressure to be applied.
3. With the test tape signal at 16 kHz, determine the point where maximum level of each channel is obtained and retighten the retaining screws (A) at that position.
4. For proper head contact, adjust the record/sync reproduce heads as necessary.

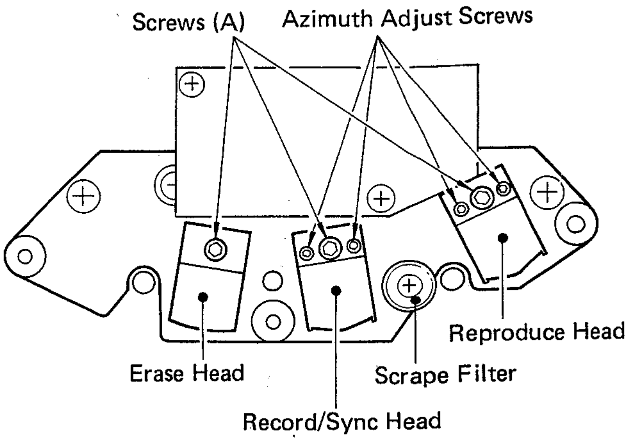


Fig. 7-27. Head Adjustment Screws

C. Head azimuth adjustment

1. Connect the OUTPUT jack for channel 2 of the deck to the vertical input terminals of an oscilloscope.
2. Connect the OUTPUT jack for channel 7 of the deck to the horizontal input terminals of the oscilloscope.
3. Connect an AF level meter to the OUTPUT jack(s) as shown in Fig. 7-28.
4. Switch the OUTPUT SELECT switch to REPRO.
5. Load the reproduce alignment test tape to reproduce. Then, a scope display reading showing phase relations between both channels will be obtained as shown in Fig. 7-29.
6. Adjust the repro head azimuth screw until the scope display shows less than 90 degree at 10 kHz out of phase with the AF level meter showing approximately maximum value for both channels.
7. Switch the OUTPUT SELECT switch to SYNC, and adjust the record/sync head azimuth screw the same way.

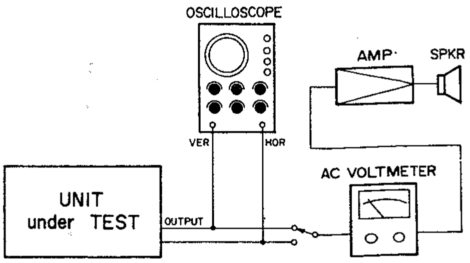
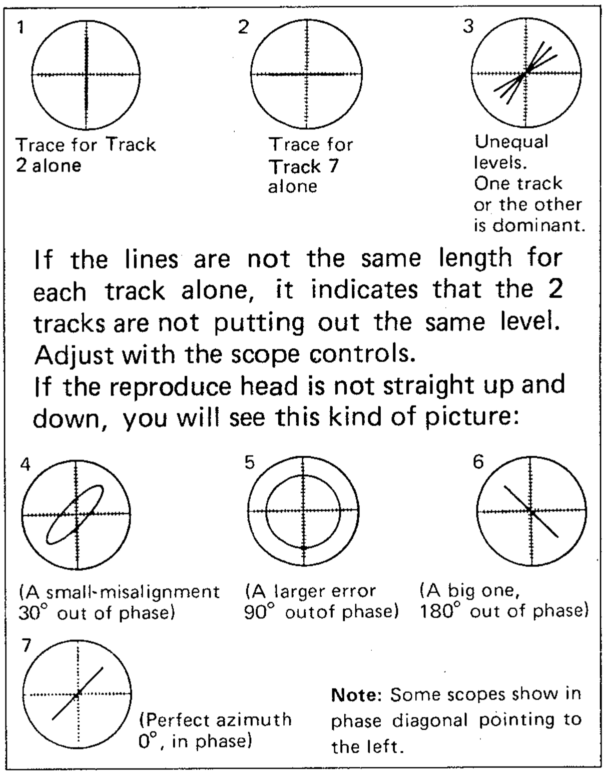


Fig. 7-28. Head Azimuth Test Set-Up


1
Trace for Track 2 alone
2
Trace for Track 7 alone
3
Unequal levels. One track or the other is dominant.
4
5
6
(A small-misalignment 30° out of phase)
(A larger error 90° outof phase)
(A big one, 180° out of phase)
7
(Perfect azimuth 0°, in phase)

If the lines are not the same length for each track alone, it indicates that the 2 tracks are not putting out the same level. Adjust with the scope controls.

If the reproduce head is not straight up and down, you will see this kind of picture:

Note: Some scopes show in phase diagonal pointing to the left.

Fig. 7-29. Phase Shift

D. Others

* To get at the trim pots for record/reproduce amplifier circuit adjustments, open the service door by removing the two set screws, one on each side of the front door. (Refer to Fig. 7-30) With the cover removed, you will see the amplifier boards to which the trim pots are mounted as shown in the photograph. The boards are identical, and are exclusively used for their respective channels. (The rightmost PCB is the Master Osc. PCB Ass'y.)

* Record/reproduce amplifier checks and adjustments are given for only one of the channels, but they should be applied for all the other channels as well.

* Line Output Load Impedance of the Deck: This deck has been preadjusted and set for a 50 k ohm load. When switched from this adjustment, for example, to a 10k ohm load, the output level results in a 0.5 dB reduction. When connecting less than a 50k ohm load, readjust the deck to match the applied load.

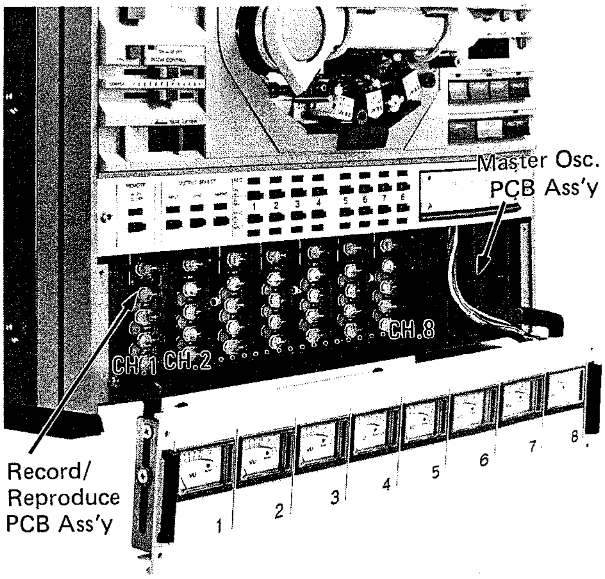

Master Osc. PCB Ass'y
CH.1
CH.2
CH.8
Record/ Reproduce PCB Ass'y
1
2
3
4
5
6
7
8

Fig. 7-30. Opening the Front Panel of the Amplifier Section

* 0 dB = 1 V

* Measurements are performed with the REMOTE switch off. The power should always be off when inserting or removing the record/reproduce amplifier PCB assembly.

* To simplify record/reproduce amplifier PCB assembly identification, mark the corresponding channel number on the silk-screen on the foil side of the PCB with a magic marker, or equivalent.

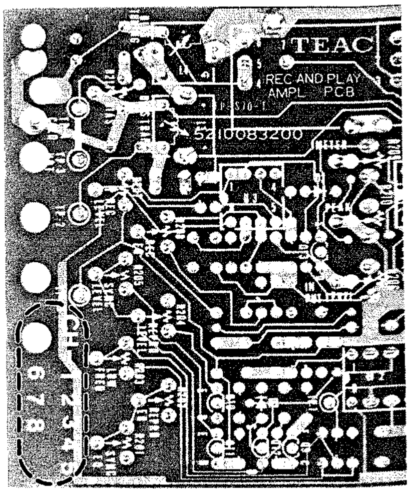

TEAC
REC AND PLAY
AMPL PCB
5210083200

Fig. 7-31. Channel Identification

7-6-2. Input Level Calibration

1. Connect the test equipment to INPUT 1 and OUTPUT 1, as shown in Fig. 7-32, and connect a 50 ohm load.
2. Apply a 1 kHz, -10 dB (0.3 V) test signal to the INPUT 1 jack on the rear panel, and switch the OUTPUT SELECT switch to INPUT.
3. Make sure the AF level meter reads -10 dB (0.3 V) output. If it doesn't, adjust the R206, 2 k ohm trim pot on the record/reproduce amplifier PCB.
4. Adjust the remaining 7 channels in the same way.

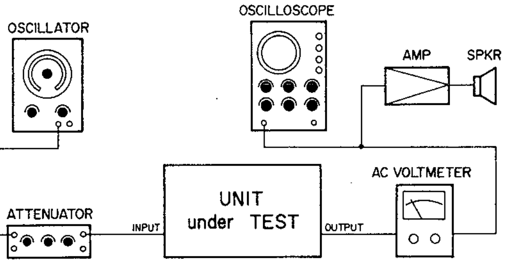


Fig. 7-32. Level or Frequency Response Measurement Set-up

7-6-3. Meter

1. Make sure that the meter indicates 0 VU after completion of the above steps 2-3, or after setting the input level to read -10 dB output. If the meter does not indicate 0 VU, adjust R209, 50 k ohms on the record/reproduce amplifier PCB.
2. Check and adjust all channels in the same way.

7-6-4. Peak LED

1. With the conditions the same as described in 7-6-2, adjust R-210, 50 k ohms so that the peak LED lights when the input level is raised 12 dB (input voltage +2 dBV) and turns off when reduced 0.5 dB (+1.5 dBV).
2. Check and adjust all channels in the same way.

7-6-5. Reproduce Level Calibration

1. Connect the AF level meter, oscilloscope to the OUTPUT 1 jack on the rear panel.
2. Switch the OUTPUT SELECT switch to REPRO.
3. Load the reproduce alignment test tape and reproduce. Observe the AF level meter, it should indicate -10 dB, if not, adjust trim pot R204, 5 k ohms on the record/reproduce amplifier PCB.
4. Switch the OUTPUT SELECT switch to SYNC and reproduce the same tape. Check the AF level meter, it should read -10 dB. If not, adjust trim pot R205, 5 k ohms on the record/reproduce amplifier PCB.
5. Check and adjust all channels in the same way.

7-6-6. Reproduce Frequency Response

After the level of all eight channels have been set, rethread the test tape.

1. When making checks and adjustments of the reproduce frequency response, you will find that its easier to cneck all eight channels at the same time by using the VU meters on the front panel, instead of checking them one at a time, and having to use an AC voltmeter and go through the trouble of plugging it into each OUTPUT pin jack to do the check. To do this though, 7-6-3 must be completed first.
2. Switch the OUTPUT SELECT switch to REPRO.
3. Reproduce the test tape and take a reading of the output levels at the specified frequencies shown in Fig. 7-33. They should be with in the specified limits shown below. If they aren't, adjust trim pot R202, 2 k ohms on the record/reproduce amplifier PCB so that the high range 18 kHz signal provides the same level reading as the 1 kHz signal.

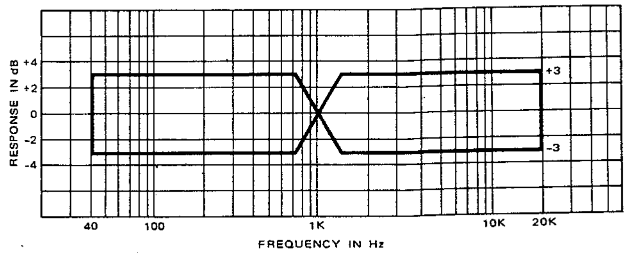


Fig. 7-33. Reproduce Frequency Response

4. Switch the OUTPUT SELECT switch to SYNC and set the REC function switch to OFF.
5. Reproduce the same tape and also read the output levels the same way to learn whether the frequency response is within the specified limit. If the frequency response is not within the specified limit, adjust trim pot R201, 2 k ohms in the same way.
6. If the specified frequency response cannot be obtained with the trim pot(s) adjusted;
    * Check and compare the measurements of the other channels. Adjust so that the level differences between channels is within 3 dB at the frequency range of 31.5 Hz – 20 kHz.
    * If all channels are off spec, check power line, incorrect head adjustments or whether heads should be cleaned.
    * Demagnetize the heads.
    * Finally, if all else fails, replace the heads.

7-6-7. Bias Tuning and Bias Trap Adjustments

These adjustments have been made at the factory and realignment will not be necessary except for the following circumstances:

* When the sync head, erase head and/or bias amplifier is replaced.
* When the MASTER BIAS PCB card or MASTER BIAS unit is replaced.

Use the following procedures to adjust.

Note

* Be sure to use a non-conductive screwdriver (i.e. wood, plastic).
* For bias level measurements, use an AC level meter of which input terminal has a floating capacitance of 100 pF or lower.

A. BIAS TUNING (L4)

1. Place all channel REC function switches to ON and set the tape deck into the record-reproduce mode.
2. Connect a DC voltmeter between TP-3 (Hot) and TP-4 (Cold). By using an insulated screwdriver, adjust L4 so that a minimum reading is obtained on the DC meter. The minimum reading should be approximately 0.35 V if the bias level trim pot R211 is correctly set to the 3 o'clock position. The voltage at pin 5 of IC U7 of the master bias oscillator should be AC 70 V ±5 V.

    An extender card is required for the adjustment of the bias tuning coil L4. Pull out the PCB assembly of the channel that's to be adjusted and insert the extender card.

    Extender Card: TEAC part No. 5200096100

CAUTION: Do not try to obtain maximum reading on the DC voltmeter. This could occasion an extreme amount of bias amplifier output load.

B. BIAS TRAP (L3, L1)

1. Connect an AC level meter between TP-2, TP-5 and ground.
2. Place all the REC function switches to ON and set the deck into the record-reproduce mode.
3. Adjust L3 so that a minimum reading is obtained on the level meter.
4. Connect an oscilloscope to the OUTPUT jacks.
5. Set the OUTPUT SELECT switch to REPRO.
6. With the deck set in the record-reproduce mode, check the amount of bias signal leaking into the reproduce amplifier.
7. Adjust trim conductor L1 so that the amount of bias leakage is minimized.

7-6-8. Bias Level

This adjustment is made while you are recording a tone on the type of tape you'll be using for the session. It will be different for each brand of tape. Before proceeding with this adjustment, make sure that the tape path and head contact have been adjusted correctly as mentioned earlier and that no tape curling is noticed.

1. Connect an AF oscillator, oscilloscope, AF level meter to the tape deck as shown in Fig. 7-32.
2. Adjust the AF oscillator to apply a 10 kHz, -10 dB (0.3 V, 0 VU) signal to INPUT 1 jack on the rear panel.
3. Switch the OUTPUT SELECT switch to REPRO and set all REC function switches to ON.
4. Begin recording channel 1. Now adjustments can be made while recording a 10 kHz tone.

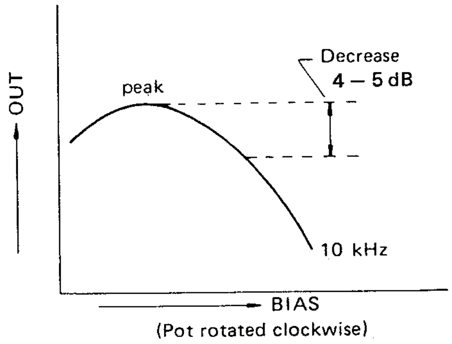


Fig. 7-34. Bias Level Adjustment

5. Begin the adjustments by turning trim pot R211, 100 k ohms completely counterclockwise. Next, turn the trim pot itself clockwise and the AF level meter will rise to give peak reading. Slowly continue the clockwise rotation until the reading on the level meter drops 4 – 5 dB from the peak reading as shown in Fig. 7-34.
6. Repeat the same procedures on the remaining 7 channels.

7-6-9. Recording Level

Recording level adjustments should be done only after the reproduce level and recording bias have been properly set as specified above.

1. Connect an AF oscillator, oscilloscope, AF level meter and a 50 k ohm load to the tape deck as shown in Fig. 7-32.
2. Apply a 1 kHz, -10 dB (0.3 V) signal to the INPUT 1 jack.
3. Switch the OUTPUT SELECT switch to REPRO and record the 1 kHz input signal on the specified recording test tape.
4. Check the AF level meter, it should indicate -10 dB (0.3 V). If it doesn't, adjust trim pot R207, 5 k ohms to obtain the -10 dB indication. At this time, make sure that the front panel VU meter indicates 0 VU.
5. Switch the OUTPUT SELECT switch to SYNC and record the 1 kHz input signal for a brief period of time. Then, rewind the tape just recorded and reproduce it. Make sure that both the AF level meter and the VU meter indicate -10 dB and 0 VU, respectively.
6. If it's impossible to obtain a VU meter reading of 0 VU in steps 4 and 5 above, check to see whether the reproduce meter is set properly as described under 7-6-3. "Meter".
7. Check and adjust the remaining 7 channels in the same way.

7-6-10. Frequency Response (OVERALL)

After completing the recording level check and adjustments, proceed onto the overall frequency response checks.

1. Connect the test equipment to the tape deck as shown in Fig. 7-32 and load a blank test tape onto the tape deck.
2. Apply a -10 dB test signal to the INPUT jack on the rear panel.
3. Switch the OUTPUT SELECT switch to REPRO and record the test signal with the frequency varied from 40 Hz to 20 kHz. Read the reproduced output levels at the proper test frequencies during recording. Make sure the frequency response obtained is within the specified limit shown in Fig. 7-35.
4. Switch the OUTPUT SELECT switch to SYNC and record the test signals the same as before. When the recording is finished, rewind the tape just recorded and reproduce it. Measure the reproduced output levels at the proper test frequencies, and make sure that the frequency response is within the specified limit shown.
5. If the frequency response reading is not within the specified limit, adjust the high frequency range through trim pot R208, 5 k ohms, or readjust the bias level setting within its specified range by refering to 7-6-8 "Bias Level". When the frequency response in the lower frequency spectrum is not within the specified limits, adjust trim pot R203, 50 k ohms. If the bias level is readjusted, the recording level adjustment will be upset, so repeat the recording level adjustments again as described in 7-6-9 "Recording Level".

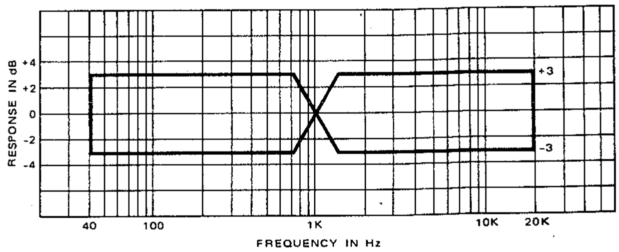


Fig. 7-35. Overall Frequency Response

7-6-11. Signal-to-Noise Ratio (OVERALL)

Before going ahead with any measurements, demagnetize all heads and tape guides.

1. Connect test equipment as shown in Fig. 7-32.
2. Apply a 1 kHz -10 dB (0.3 V = 0 VU) input signal to the INPUT 1 jack on the rear panel.
3. Switch the OUTPUT SELECT switch to SYNC and record a short length of the input signal. Then, while still in the recording mode, unplug the AF oscillator connected to the INPUT 1 jack, and make another length of no-signal recording.

4. Rewind the recording made in step 3 to the beginning and reproduce.
5. While making sure the reproduce output of the perviously recorded 1 kHz 0 VU signal is -10 dB, raise the sensitivity of the AF level meter and measure the level of the no-signal portion of the tape.
6. With -10 dB (0 VU) as the reference level, the signal-to-noise ratio, as measured by the AF level meter, should be better than 50 dB.
7. If it is off spec,
   - * Check and compare the measurement of the other channels. If they stand up to spec, correct or replace the off spec channel record/reproduce amplifier PCB.
   - * Demagnetize the heads.
   - * Check erasure, refer to 7-6-12.
   - * Check for proper adjustment of the bias trap.
   - * Try another tape of the same type number.

Test point TP-1, located on the record/reproduce amplifier PCB, is an output terminal reserved for performing checks when noise is generated. Voltage at this terminal is DC 5 mV, or lower when offset.

7-6-12. Erase Ratio

1. Connect test equipment to the tape deck as shown in Fig. 7-36.
2. Use a 1 kHz bandpass filter to check the erasing ratio.
3. Switch the OUTPUT SELECT switch to SYNC and record a short length of the 1 kHz, 0 dB (1 V) signal and unplug the AF oscillator connected to the INPUT jack on the rear panel.
4. Rewind the tape to the beginning of the recorded section.
5. Record a no-signal portion over the recording of the 1 kHz signal.
6. Measure the difference between the 1 kHz signal level and the no-signal portion. The difference should be at least 70 dB.
7. If the level difference is below this specification, check erase head output voltage for 65 – 75 V using an AC voltmeter.
   If necessary, adjust the erase head position by loosening the screw located behind the erase head.

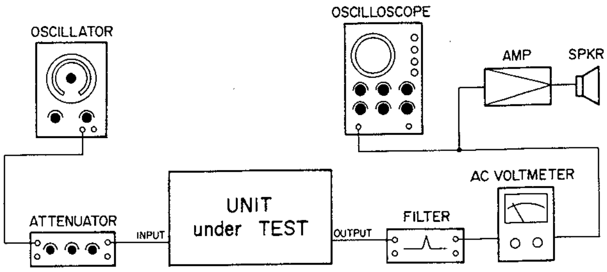


Fig. 7-36. Erase Ratio Test Set-Up

7-6-13. Adjacent Channel Crosstalk

1. Connect test equipment as shown in Fig. 7-37.
2. While making a no-signal recordings on one of the channels, apply a 1 kHz -10 dB (0.3 V) test signal to the adjacent channel.
3. Rewind the tape to the beginning of the recording.
4. Reproduce the tape with the OUTPUT SELECT switch set to SYNC, after which, measure the output (signal leakage) of the no-signal recorded channel.
5. Measure the difference between the 1 kHz nominal output level and the no signal portion. The difference should be 50 dB or greater.

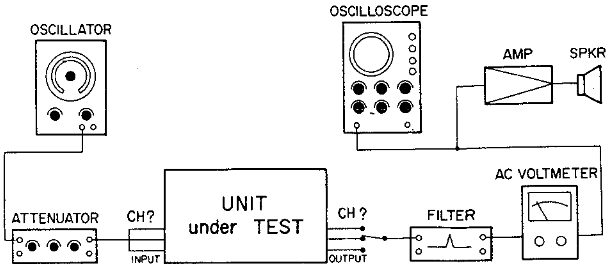


Fig. 7-37. Crosstalk Measurement Set-Up

7-6-14. Distortion

1. Connect test equipment as shown in Fig. 7-38.
2. Switch the OUTPUT SELECT switch to REPRO.

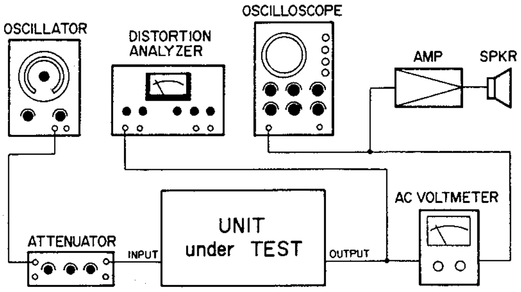

OSCILLOSCOPE
OSCILLATOR
DISTORTION ANALYZER
AMP
SPKR
AC VOLTMETER
UNIT under TEST
ATTENUATOR
INPUT
OUTPUT

Fig. 7-38. Distortion Measurement Set-Up

3. Apply a 1 kHz, -10 dB (0.3 V) test signal to the INPUT jack and reproduce. Measure the distortion of the reproduced output with a distortion analyzer connected to the OUTPUT jack.
4. Stop the recording and switch the OUTPUT SELECT switch to SYNC.
5. Rewind the tape to its beginning and reproduce. Measure the distortion of the reproduced output.
6. The distortion measured should be less than 0.8 % for a -10 dB recording.
7. If the distortion is off spec;
   * Check and compare the measurements of the other channels. If they are off spec, correct or replace the off spec channel record/reproduce amplifier PCB.
   * Check bias level setting and readjust if necessary.
   * Demagnetize the heads.
   * Replace the heads.

8. EXPLODED VIEWS, ASSEMBLIES, PARTS LISTS AND CIRCUIT SCHEMATICS

NOTES

- ★ Parts marked with * require longer delivery time.
- ★ All resistors are 1/4 watts, 5 %, unless marked otherwise. Resistor values are in ohms (K=1,000-ohms, M=1,000,000 ohms).
- ★ All capacitor values are in microfarads (p=pico-farads).
- ★ ⚠ Parts marked with this sign are safety critical components. They must always be replaced with identical components — refer to the TEAC Parts List and ensure exact replacement.
- ★ 0 dB is referenced to 1 V in this manual unless otherwise specified.
- ★ PC boards shown viewed from electro-parts side.

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8. EXPLODED VIEWS, ASSEMBLIES, PARTS LISTS AND CIRCUIT SCHEMATICS

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- ★ 0 dB is referenced to 1 V in this manual unless otherwise specified.
- ★ PC boards shown viewed from electro-parts side.

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TASCAM 58

SUPPLEMENT NOTICE

We are hereby taking this opportunity to release the remote control information which was under compilation at the time the TASCAM 58 OPERATION/MAINTENANCE Manual (#5700039300) was completed.
Please retain this information on file by seeing that the concerning pages are inserted into their proper places in the manual. The newly provided replacements may be used to replace the pages that demand correction.

Replacements:		Page
1. Cover page	(New manual number)	—
2. Table of contents	(Corrected)	—
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8-3-11 Remote Control Unit, RC-51 (Circuit Schematic) .... 8 - 56

Correction:

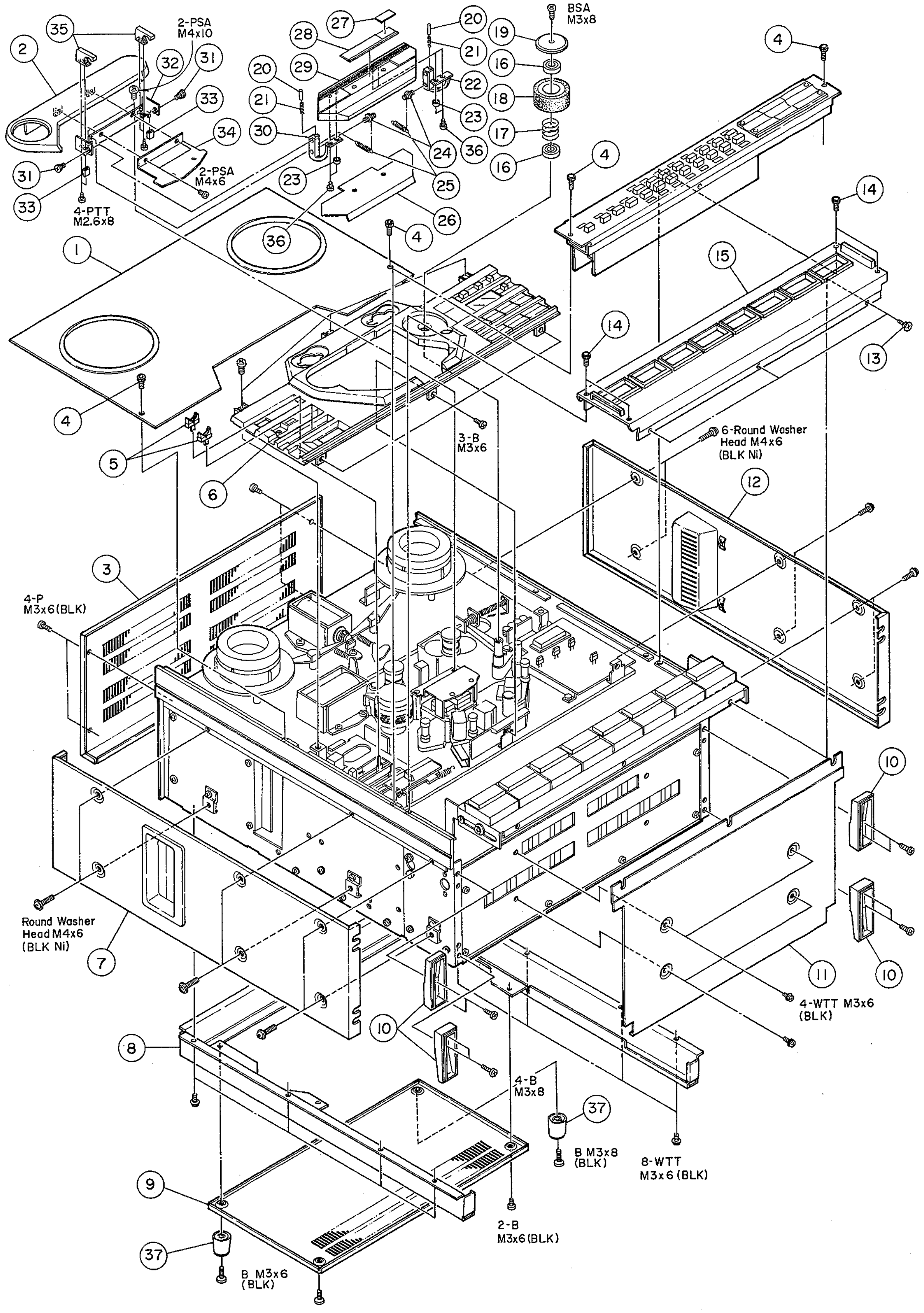
Page 1-10, Right column, second paragraph from the bottom.

FORGET THE NOTION THAT dBm REQUIRES 1600 OHM . . . ,
should be read as: . . . . REQUIRES A 600 OHM . . . .

TEAC CORPORATION

8-1. MECHANICS – EXPLODED VIEWS AND PARTS LISTS

8-1-1. Exploded View–1 (58 Overall)


2-PSA M4x10
BSA M3x8
2-PSA M4x6
4-PTT M2.6x8
3-B M3x6
6-Round Washer Head M4x6 (BLK Ni)
4-P M3x6(BLK)
Round Washer Head M4x6 (BLK Ni)
4-WTT M3x6 (BLK)
4-B M3x8
B M3x8 (BLK)
8-WTT M3x6 (BLK)
2-B M3x6(BLK)
B M3x6 (BLK)
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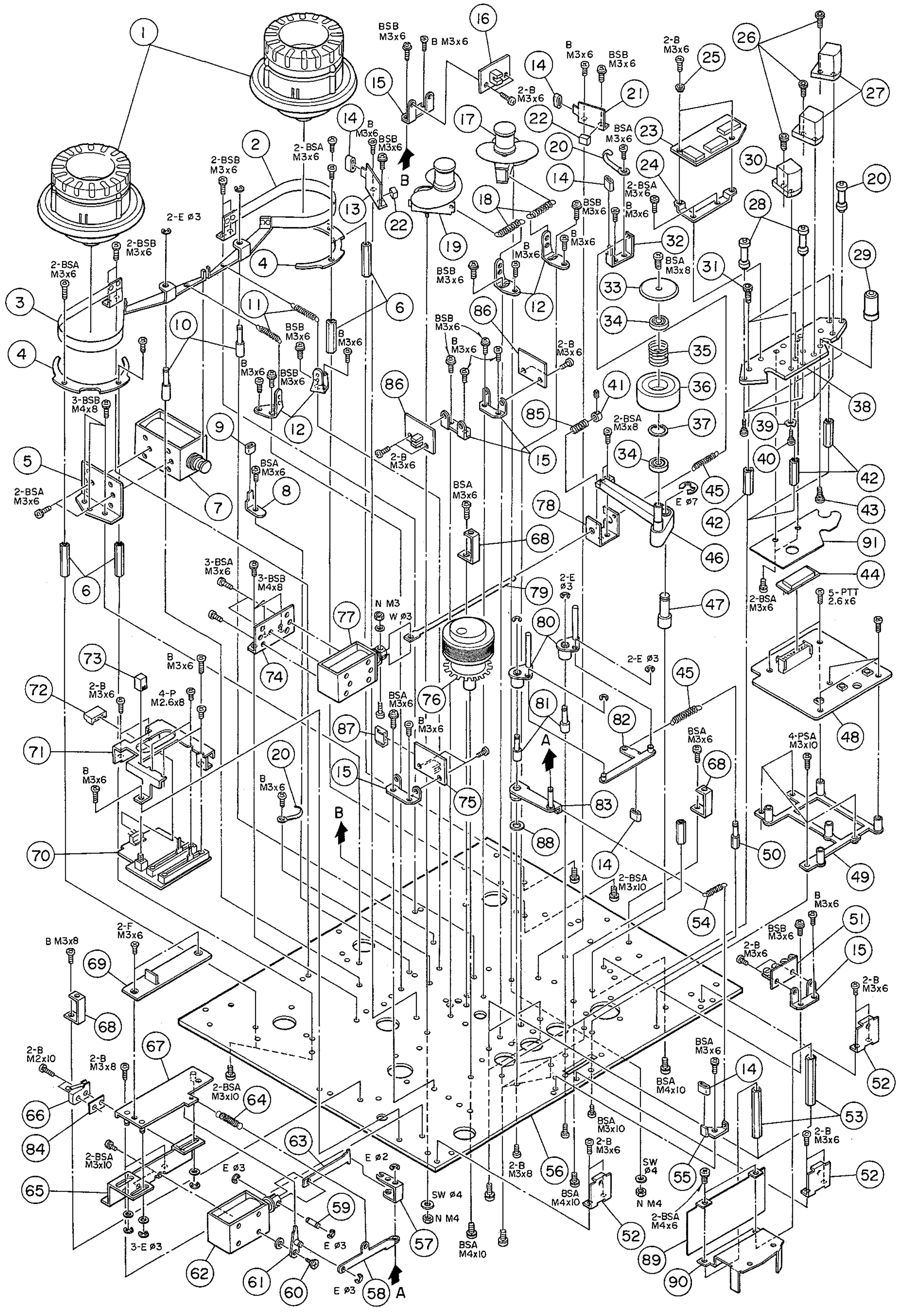
Exploded View–1

Parts marked with * require longer delivery time.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
1 - 1	*5800351000	Panel A Assy, Front	
1 - 2	*5800396200	Head Housing; B	
1 - 3	*5800343000	Top Cover	
1 - 4	*5781704008	Cap screw M4 x 8 (Ni)	
1 - 5	5800341700	Knob, Fader	
1 - 6	*5800351101	Panel A Assy, Transport	
1 - 7	*5800351600	Panel, Side; R	
1 - 8	*5800345200	Side Cover, A	
1 - 9	*5800345300	Panel, Rear; A	
1 - 10	5800288500	Foot	
1 - 11	*5800346100	Plate, Bottom	
1 - 12	*5800351500	Panel Arm, Side; L	
1 - 13	*5800400900	Screw, Shoulder; A	
1 - 14	*5781703006	Cap Screw M3 x 6 (Ni)	
1 - 15	*5800351300	Panel Assy, Ampl; A	
1 - 16	*5730002100	Bearing, 626Hz	
1 - 17	*5800280600	Spring, Pinch Roller	
1 - 18	5800347600	Pinch Roller	
1 - 19	5800398600	Cap, Pinch Roller	
1 - 20	*5786323010	Pin; B	
1 - 21	*5800396900	Spring; B	
1 - 22	*5800396400	Holder, Housing; R	
1 - 23	*5800436000	Spacer	
1 - 24	*5800397800	Shaft	
1 - 25	*5800396800	Spring; A	
1 - 26	*5800404800	Plate, Shield; D	
1 - 27	*5800340200	Plate, Name; B [J]	
	*5800340100	Plate, Name; A [All except J]	
1 - 28	*5800307400	Plate, Housing; 1 [J]	
	*5800307500	Plate, Housing; 2 [All except J]	
1 - 29	*5800396100	Head Housing; A	
1 - 30	*5800396301	Holder, Housing; L	
1 - 31	*5800404400	Screw, Shoulder; B	
1 - 32	*5800396500	Bracket, Housing	
1 - 33	*5800398500	Cushion	
1 - 34	*5800436100	Bracket, Housing; B	
1 - 35	*5800396600	Stopper, Housing	
1 - 36	*5781703008	Cap Screw M3 x 8 (Ni)	
1 - 37	*5504552000	Foot; T-A	

[U]: U.S.A. [C]: CANADA [GE]: GENERAL EXPORT
[A]: AUSTRALIA [E]: EUROPE [UK]: U.K.
[L]: LIMITED AREA [J]: JAPAN

8-1-2. Exploded View—2 (Transport Unit, Front Section)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BSB M3x6
B M3x6
2-B M3x6
BSA M3x6
2-BSA M3x6
2-BSB M3x6
2-E ø3
3-BSB M4x8
3-BSA M3x6
BSA M3x8
4-P M2.6x8
N M3
W ø3
E ø7
5-PTT 2.6x6
4-PSA M3x10
2-F M3x6
B M3x8
2-B M2x10
2-B M3x8
2-BSA M3x10
E ø2
E ø3
3-E ø3
SW ø4
N M4
BSA M4x10
2-BSA M4x6
BSA M3x10

Exploded View—2

Parts marked with *require longer delivery time

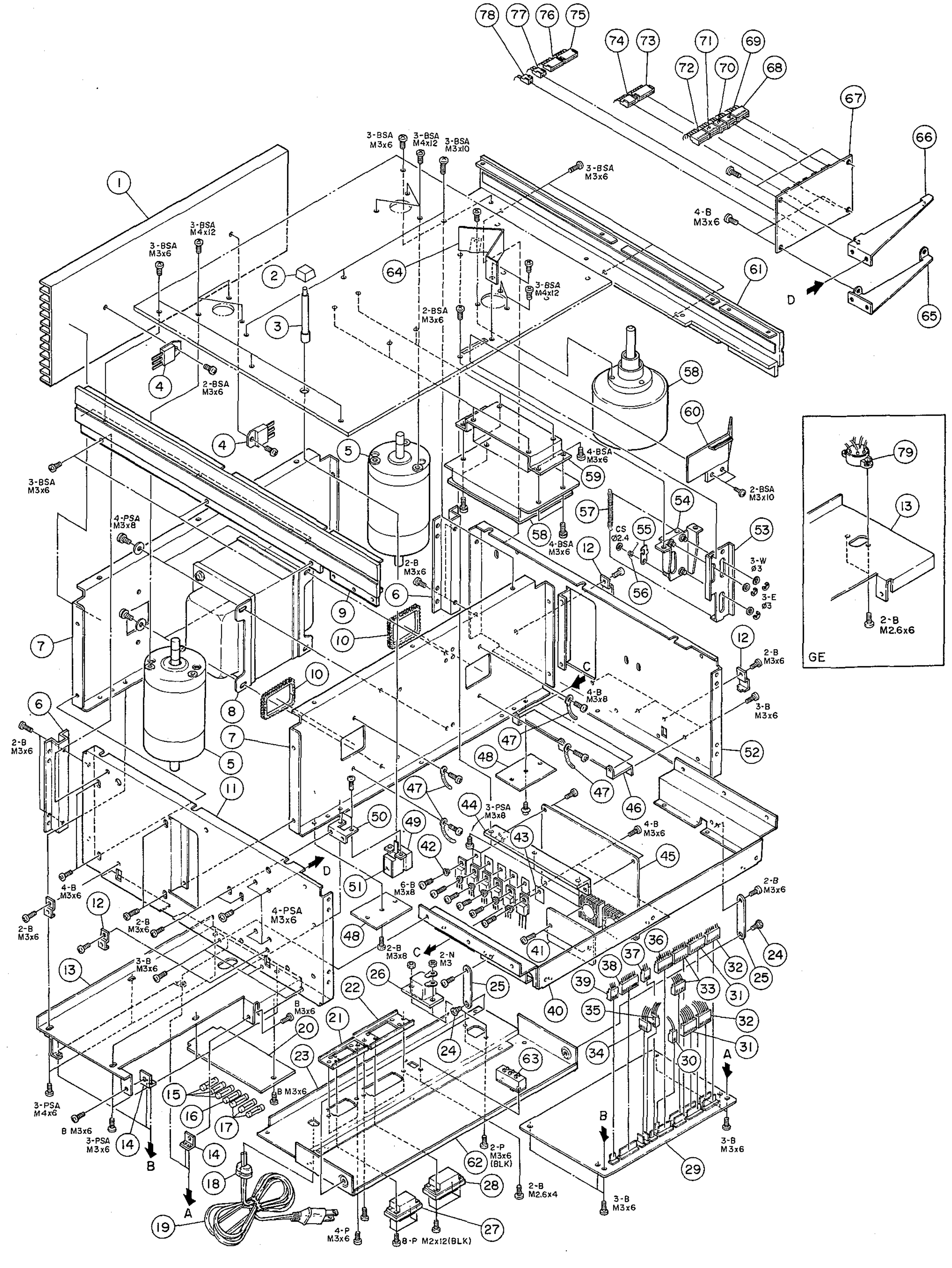
REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
2- 1	5800349900	Table Assy, Reel [J]	
2- 1	5800400500	Table Assy, Reel [All except J]	
2- 2	*5800333500	Arm Assy, Brake; R	
2- 3	*5800333400	Arm Assy, Brake; L	
2- 4	*5555272000	Retainer, Band	A-3300SX
2- 5	*5800336800	Bracket, Solenoid	
2- 6	*5800335401	Stud, Band	
2- 7	*5313001700	Solenoid, Brake	
2- 8	*5800336500	Stopper	
2- 9	*5027569000	Cushion, Stopper	
2- 10	*5800335300	Shaft, Brake Arm	
2- 11	*5800380800	Spring, Brake	
2- 12	*5800336100	Hook, Spring	
2- 13	*5800336300	Stopper; L	
2- 14	*5027569000	Cushion, Stopper	
2- 15	*5800336200	Holder, Sensor PCB	
2- 16	*5200082700	PCB Assy, END SENSOR	
2- 17	5800331101	Arm Assy, Tension; R	
2- 18	*5800380100	Spring, Tension	
2- 19	5800331001	Arm Assy, Tension; L	
2- 20	*5581038000	Clamper, Cord	
2- 21	*5800336400	Stopper; R	
2- 22	*5534851000	Dumper, Arm	
2- 23	*5200088600	PCB Assy, Head	
2- 24	*5800402700	Bracket, Connector PCB	
2- 25		Not applicable	
2- 26		Not applicable	
2- 27	5378300400	Head, REC/PLAY	
2- 28	*5800338100	Guide Assy, Tape	
2- 29	*6013024000	Filter Assy, Scrap; 1/4	80-8
2- 30	5378300200	Head, ERASE	
2- 31	5781704010	Bolt, Cap M4 x 10	
2- 32	*5800337100	Stopper, Arm	
2- 33	5800398600	Cap, Pinch Roller	
2- 34	*5730002100	Bearing	
2- 35	*5800380600	Spring, Pinch Roller	
2- 36	5800347600	Pinch Roller	
2- 37	*5786131900	Ring; C	
2- 38	*5800346900	Base, Head	
2- 39	*5785150400	Wave Washer	
2- 40	*5800348700	Screw	
2- 41	*5800369500	Stopper, Spring	
2- 42	*5800337700	Stud, Head Base	
2- 43	*5781703006	Cap Screw M3 x 6 (Ni)	
2- 44	5225009600	Indicator, LED	
2 -- 45	*5800398700	Spring, Lifter Level	
2- 46	*5800332300	Arm Assy, Pinch Roller	
2- 47	*5800335700	Stud, Pinch Roller Arm	
2- 48	*5200082100	PCB Assy, KEY BOARD	
2- 49	*5800342200	Holder, PCB	

[U]: U.S.A.
[C]: CANADA
[GE]: GENERAL EXPORT
[A]: AUSTRALIA
[E]: EUROPE
[UK]: U.K.
[L]: LIMITED AREA
[J]: JAPAN

Parts marked with *require longer delivery time.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
2 - 50	*5800335200	Hook, Spring	
2 - 51	*5200083100	PCB Assy, VR	
2 - 52	*5800339300	Bracket, Panel; A	
2 - 53	*5800396700	Stud, Head Housing	
2 - 54	*5800398800	Spring, CUE return	
2 - 55	*5800336900	Stopper, CUE	
2 - 56	*5800337901	Base, Transport	
2 - 57	*5800337000	Arm Assy, Pivot; A	
2 - 58	*5800337200	Link, CUE; B	
2 - 59	*5545022000	Pin, Solenoid	
2 - 60	*5581056000	Screw, Shoulder; A	
2 - 61	*5800334300	Link Assy, CUE	
2 - 62	5313001900	Solenoid	
2 - 63	*5800337600	Rod, Lifter	
2 - 64	*5800381700	Spring, CUE Lever	
2 - 65	*5800350500	Bracket, Solenoid	
2 - 66	*5301455500	Micro Switch	
2 - 67	5800369100	Slider Assy	
2 - 68	*5800339400	Bracket, Panel; B	
2 - 69	5800396001	Knob, CUE	
2 - 70	*5200082200	PCB Assy, PITCH CONTROL	
2 - 71	*5800335000	Holder, PCB	
2 - 72	5122169000	Connector Socket, 9P	
2 - 73	5800382400	Button	
2 - 74	*5800336800	Bracket, Solenoid; Pinch Roller	
2 - 75	*5200082500	PCB Assy, SPEED SENSOR	
2 - 76	*5800338201	Roller Assy, Counter	
2 - 77	5313001800	Solenoid	
2 - 78	*5800369400	Holder, Spring	
2 - 79	*5800336700	Link Pinch Roler Arm	
2 - 80	*5800332700	Arm Assy, Lifter	
2 - 81	*5800335600	Stud, Lifter Arm	
2 - 82	*5800333100	Link Assy, Lifter	
2 - 83	*5800334000	Arm Assy, Pivot	
2 - 84	*5800401300	Plate, Insulating	
2 - 85	*5800380500	Pressure Spring, Pinch Roller	
2 - 86	*5200082600	PCB Assy, Tension Sensor	
2 - 87	*5122664000	Connector Socket, 4P	
2 - 88	*5122154000	Spacer	
2 - 89	*5800404700	Plate, Shield; C	
2 - 90	*5800436200	Bracket, Housing; C	
2 - 91	*5800403600	Plate, Shield; A	

8-1-3. Exploded View—3 (Transport Unit, Rear Section)



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3-BSA M3x6
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3-BSA M4x12
3-BSA M3x6
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3-BSA M4x12
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3-B M3x6
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4-P M3x6
8-P M2x12(BLK)
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2-B M2.6x6
GE

Exploded View—3

Parts marked with *require longer delivery time.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
3- 1	*5800342500	Heatsink; A	
3- 2	*5800173100	Button, Power	133
3- 3	*5534855000	Rod, Switch	
3- 4	⚠ 5231758800	Transistor 2SD1047(E), Q21, Q22	
3- 5	5370002700	Motor Assy, Reel	38
3- 6	*5800339700	Bracket, Case; A	
3- 7	*5800343500	Bracket, Power Transformer	
3- 8	⚠ *5320016100	Transformer, Power [J]	
	⚠ *5320016200	Transformer, Power [U, C]	
	⚠ *5320016300	Transformer, Powr [GE]	
	⚠ *5320016400	Transformer, Power [E, UK, A]	
3- 9	*5800344400	Sash, Side; L	
3- 10	*5786740100	Bush, Free SG-16	
3- 11	*5800343300	Chassis, Side; L	
3- 12	*5800339900	Bracket Case; C	
3- 13	*5800343600	Bracket Assy, PCB; D	
3- 14	*5800339800	Bracket, PCB; A	
3- 15	⚠ 5307004100	FUSE, 2A 250V [J, U, C, GE]	
	⚠ 5142189000	FUSE, T2A 250V [E, UK, A]	
3- 16	⚠ 5307004300	FUSE, 3A 250V [J, U, C, GE]	
	⚠ 5142191000	FUSE, T3.15A 250V [E, UK, A]	
3- 17	⚠ 5307004700	FUSE, 7A 250V [J, U, C, GE]	
	⚠ 5142193000	FUSE, T5A 250V [E, UK, A]	
3- 18	*5534660000	Strain Relief, AC Power Cord [J, GE, E, A]	
	*5534661000	Strain Relief, AC Power Cord [U, UK]	
3- 18	*5534662000	Strain Relief, AC Power Cord [C]	
3- 19	⚠ *5128027000	Cord, AC Power [J]	
	⚠ *5128075000	Cord, AC Power [GE]	
	⚠ *5350008200	Cord, AC Power [E]	
	⚠ *5128047000	Cord, AC Power [UK]	
	⚠ *5128098000	Cord, AC Power [U]	
	⚠ *5350008100	Cord, AC Power [C]	
	⚠ *5350008300	Cord, AC Power [A]	
3- 20	*5210081800	PCB, FUSE [J, U, C, GE]	
	*5210081900	PCB, FUSE [E, UK, A]	
3- 21	*5800194001	Plate, Connector; B	
3- 22	*5800194101	Plate, Connector; C	
3- 23	*5800405400	Rear Panel, Ampl; E	
3- 24	*5581056000	Shaft, Shoulder	
3- 25	*5800338600	Arm; A	
3- 26	*5122339000	Connector Socket, 6P	
3- 27	*5334013300	Connector Socket, 56P	
3- 28	*5334012900	Connector Socket, 38P	
3- 29	*5200082900	PCB Assy, CONTROL	
2- 30	*5122164000	Connector Socket, 2P	
3- 31	*5122172000	Connector Socket, 10P (WHT)	
3- 32	*5122174000	Connector Socket, 12P (WHT)	
3- 33	*5122168000	Connector Socket, 6P (WHT)	
3- 34	*5122165000	Connector Socket, 3P (WHT)	
3- 35	*5122281000	Connector Socket, 3P (RED)	

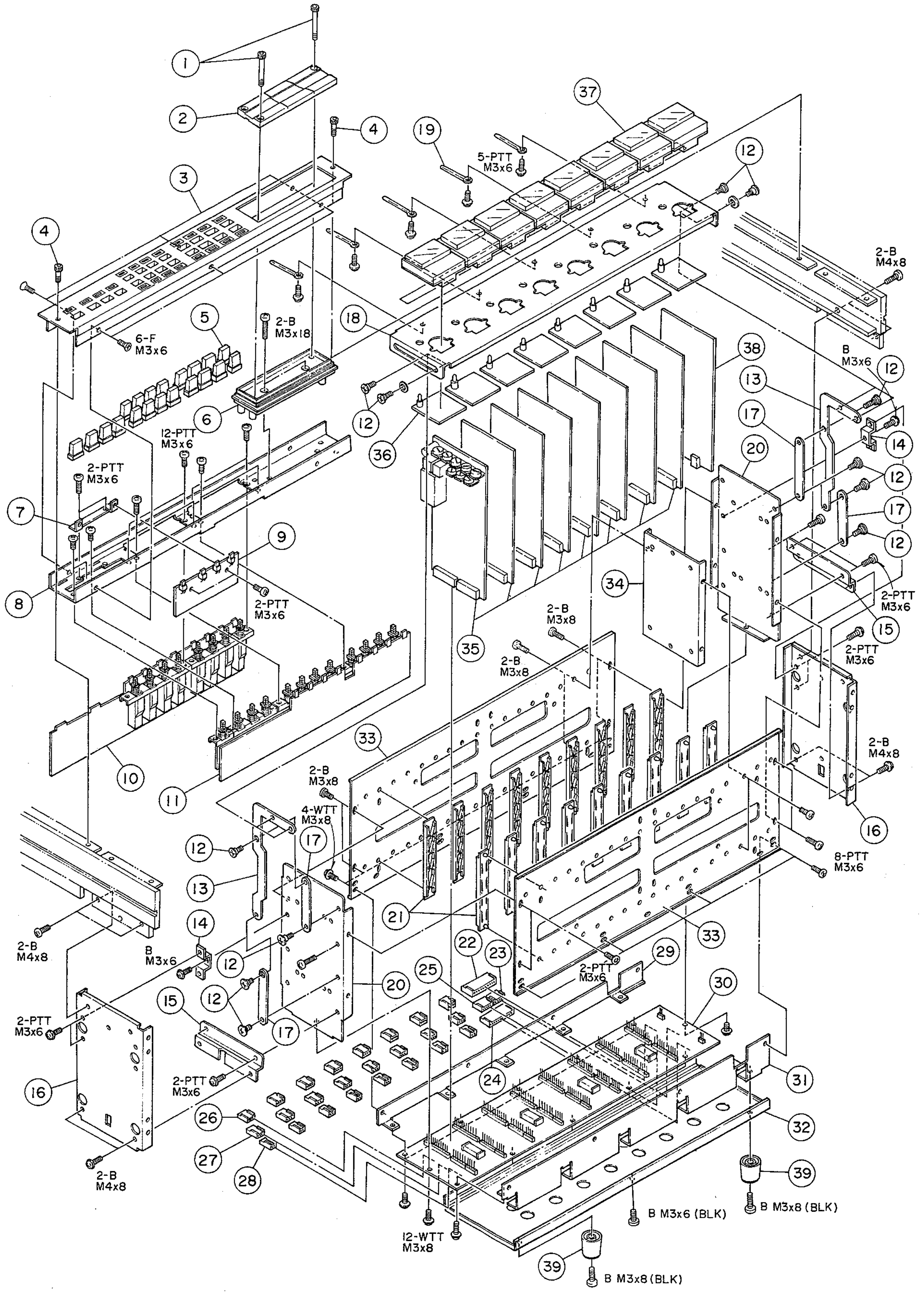
[U]: U.S.A.
[C]: CANADA
[GE]: GENERAL EXPORT
[A]: AUSTRALIA
[E]: EUROPE
[UK]: U.K.
[L]: LIMITED AREA
[J]: JAPAN

Parts marked with *require longer delivery time.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
3- 36	*5122171000	Connector Socket, 9P	
3- 37	*5122166000	Connector Socket, 4P	
3- 38	*5122173000	Connector Socket, 11P	
3- 39	*5122283000	Connector Socket, 5P(RED)	
3- 40	*5800342900	Bracket, Rear Panel	
3- 41	*5800350700	Heatsink, PS; B	
3- 42	*5033295000	Tube, Insulating	
3- 43	*5033291000	Plate, Insulating	
3- 44	*5800350600	Heatsink, PS; A	
3- 45	*5200082800	PCB Assy, POWER	
3- 46	*5800350800	Holder, PS PCB	
3- 47	*5786714000	Clamper, Cord; ϕ4	
3- 48	*5200082000	PCB Assy, JOINT	
3- 49	⚠ *5052910000	Spark Killer 0.033μF + 120/125V [U]	
	⚠ *5052911000	Spark Killer 0.033μF + 120/250V [C]	
	⚠ *5052907000	Spark Killer 0.01μF + 300/300V [J, GE]	
	⚠ *5267702500	Spark Killer 0.0047μF + 120/125V [E, UK, A]	
	⚠ *5267702600	Spark Killer 0.047μF/250V [E]	
3- 50	*5800338400	Bracket, Switch; A	
3- 51	⚠ 5300017900	Switch, Push [J]	
	⚠ 5134036000	Switch, Push [GE]	
	⚠ 5134037000	Switch, Push [U]	
	⚠ 5234018000	Switch, Push [C]	
	⚠ 5134011000	Switch, Push [E, UK, A]	
3- 52	*5800343400	Chassis, Side; R	
3- 53	*5800330600	Slide Plate Assy, Shield	
3- 54	*5800330300	Base Assy, Shield	
3- 55	*5084643200	Plate, Lock	
3- 56	*5800380000	Spring, Lock	
3- 57	*5800380100	Spring, Tension	
3- 58	5370003200	DC Motor, Capstan	
3- 59	*5800337500	Holder, SERVO PCB	
3- 60	*5800349400	Plate, Head Shield	
3- 61	*5800344500	Sash, Side; R	
3- 62	*5800404600	Rear Panel, Ampl; D	
3- 63	*6051604000	Switch, Slide 2-2	
3- 64	*5800403700	Plate, Shield; B	
3- 65	*5800435900	Bracket, PCB; R	
3- 66	*5800435800	Bracket, PCB; L	
3- 67	*5200099600	PCB Assy, INTERFACE	
3- 68	*5122287000	Connector, Socket 9P (RED)	
3- 69	*5122168000	Connector, Socket 6P (WHT)	
3- 70	*5122166000	Connector, Socket 4P (WHT)	
3- 71	*5122169000	Connector, Socket 7P (WHT)	
3- 72	*5122171000	Connector, Socket 9P (WHT)	
3- 73	*5122290000	Connector, Socket 12P (RED)	
3- 74	*5122170000	Connector, Socket 8P (WHT)	
3- 75	*5122172000	Connector, Socket 10P (WHT)	
3- 76	*5122280000	Connector, Socket 10P (RED)	
3- 77	*5122165000	Connector, Socket 3P (WHT)	
3- 78	*5122164000	Connector, Socket 2P (WHT)	
3- 79	*5302101200	Switch, Voltage Selector [GE]	

[U]: U.S.A.
[C]: CANADA
[GE]: GENERAL EXPORT
[A]: AUSTRALIA
[E]: EUROPE
[UK]: U.K.
[L]: LIMITED AREA
[J]: JAPAN

8-1-4. Exploded View—4 (Function, Amplifier Section)



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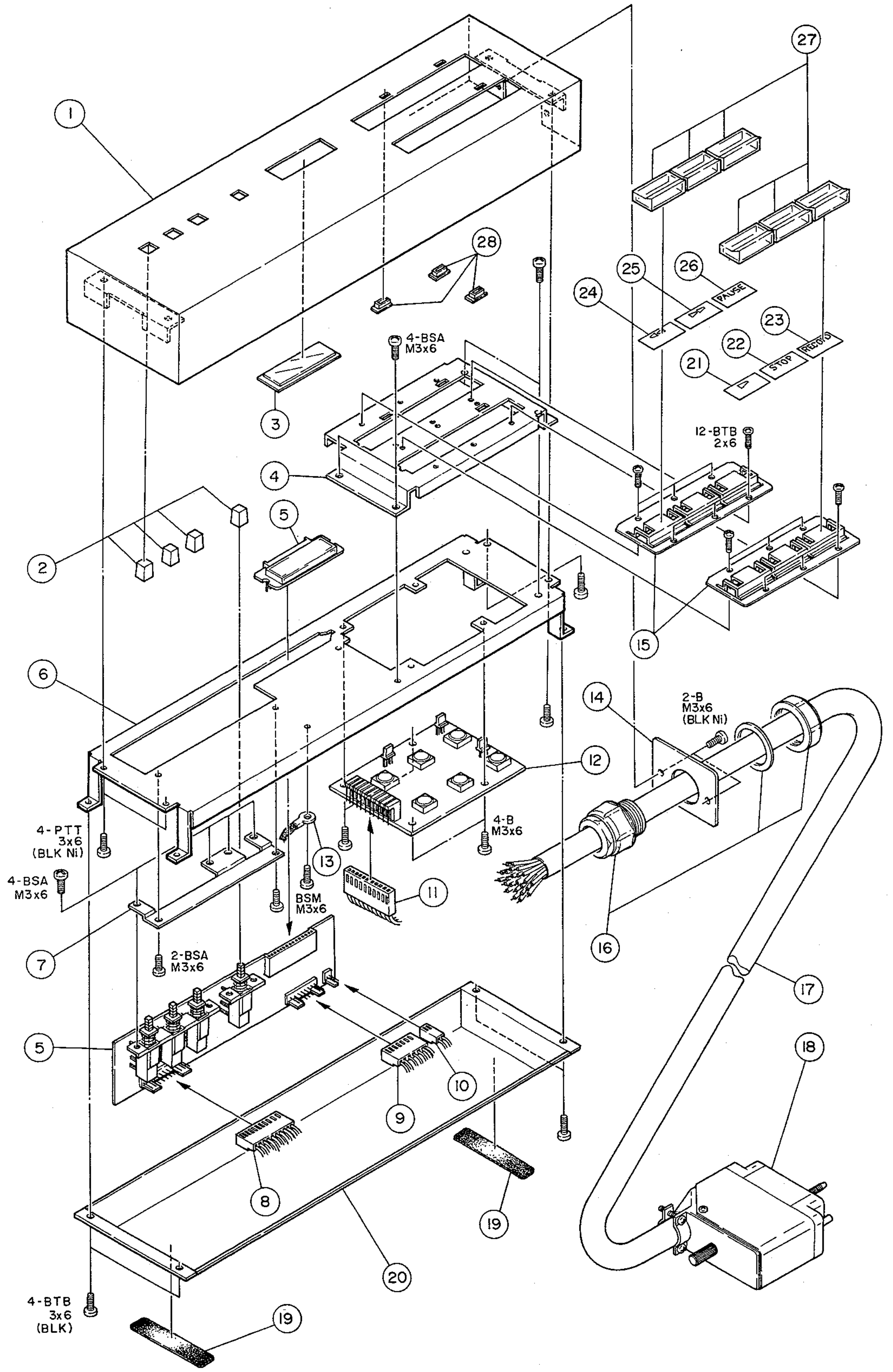
6-F M3x6
2-B M3x18
12-PTT M3x6
2-PTT M3x6
B M3x6
2-B M3x8
4-WTT M3x8
2-PTT M3x6
8-PTT M3x6
2-B M4x8
2-PTT M3x6
12-WTT M3x8
B M3x6 (BLK)
B M3x8 (BLK)
B M3x8 (BLK)

Exploded View—4

Parts marked with *require longer delivery time.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
4- 1	*5782703030	Cap Screw M3 x 30 (Ni)	
4- 2	*5800383500	Block, Splicing	
4- 3	*5800351200	Panel A Assy, Function	
4- 4	*5781704008	Cap Screw M4 x 8 (Ni)	
4- 5	5800378900	Button, Right	
4- 6	*5800382500	Base, Splicing	
4- 7	*5800338300	Bracket, PCB; E	
4- 8	*5800343700	Chassis, Function	
4- 9	*5200083000	PCB Assy, LED	
4- 10	*5200082400	PCB Assy, FUNCTION B	
4- 11	*5200082300	PCB Assy, FUNCTION A	
4- 12	*5581056000	Screw, Shoulder; A	
4- 13	*5800339500	Plate, Joint	
4- 14	*5800339200	Bracket, Ampl.; B	
4- 15	*5800339100	Bracket, Ampl.; A	
4- 16	*5800343100	Chassis, Ampl.; A	
4- 17	*5800339000	Arm; B	
4- 18	*5800343800	Chassis, Ampl.	
4- 19	*5581038000	Clamper, Cord; A	
4- 20	*5800341800	Chassis, Ampl. Side; L	
4- 21	*5730003200	Guide, PCB	
4- 22	*5122171000	Connector Socket, 9P	
4- 23	*5122167000	Connector Socket, 5P	
4- 24	*5122170000	Connector Socket, 8P	
4- 25	*5122281000	Connector Socket, 3P (RED)	
4- 26	*5122166000	Connector Socket, 4P	
4- 27	*5122165000	Connector Socket, 3P	
4- 28	*5122164000	Connector Socket, 2P	
4- 29	*5800344100	Bracket, PCB; B	
4- 30	*5200083400	PCB Assy, MOTHER	
4- 31	*5800344000	Bracket, PCB; A	
4- 32	*5800346000	Panel, Rear Ampl.; A	
4- 33	*5800343900	Bracket, PCB Guide; A	
4- 34	*5800342000	Bracket, PCB Guide; B	
4- 35	*5200083200	PCB Assy, REC/PLAY AMPL.	
4- 36	5225611400	LED, SLP144B	
4- 37	5296005000	Meter, VU	
4- 38	*5200083300	PCB Assy, MASTER OSC	
4- 39	*5504552000	Foot; T-A	

8-1-5 Remote Control Unit, RC-50 Exploded View


1
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24
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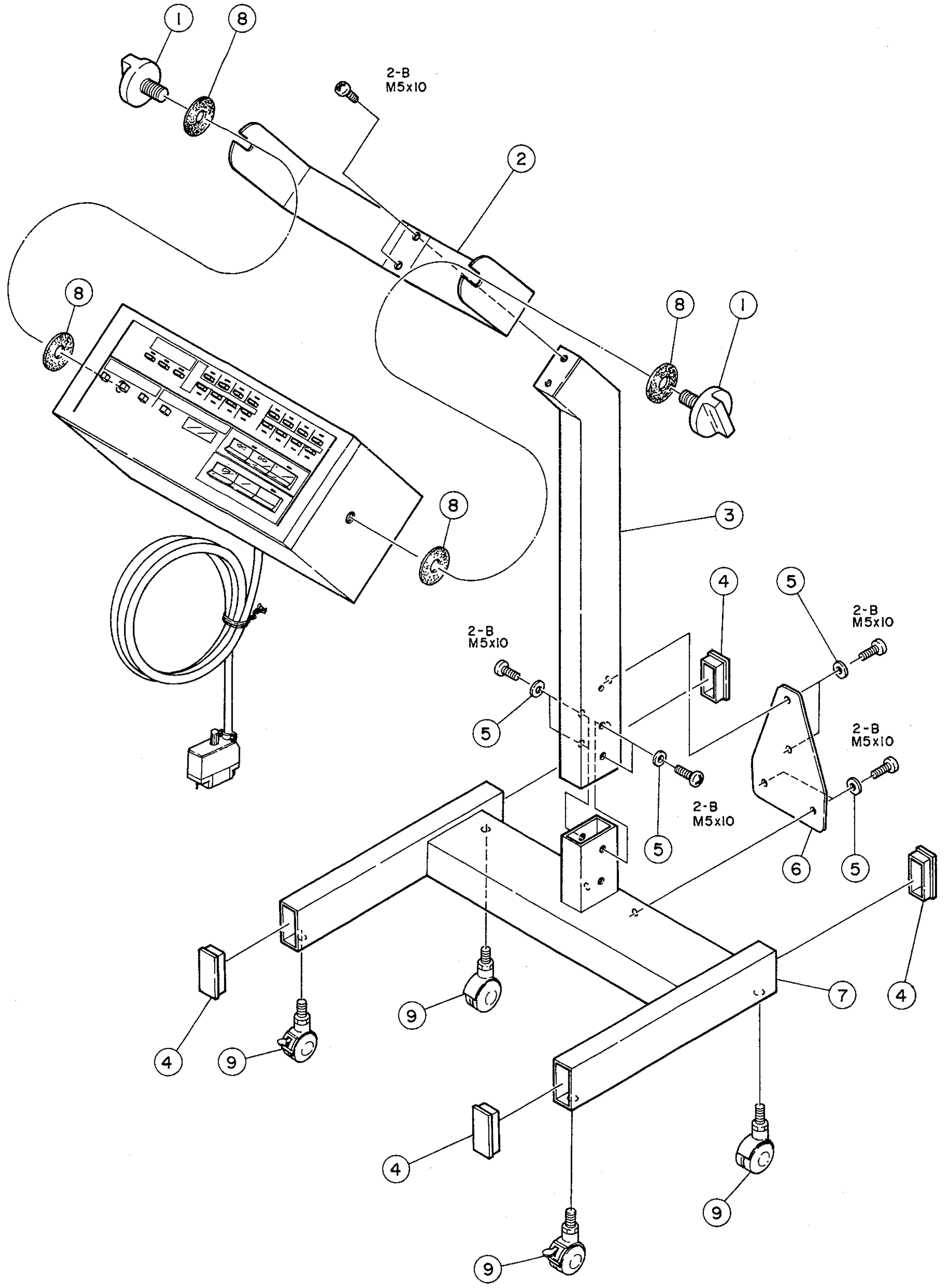
26
27
28
4-BSA M3x6
12-BTB 2x6
2-B M3x6 (BLK Ni)
4-B M3x6
4-PTT 3x6 (BLK Ni)
4-BSA M3x6
BSM M3x6
2-BSA M3x6
4-BTB 3x6 (BLK)
PAUSE
STOP
RECORD

Exploded View (RC-50)

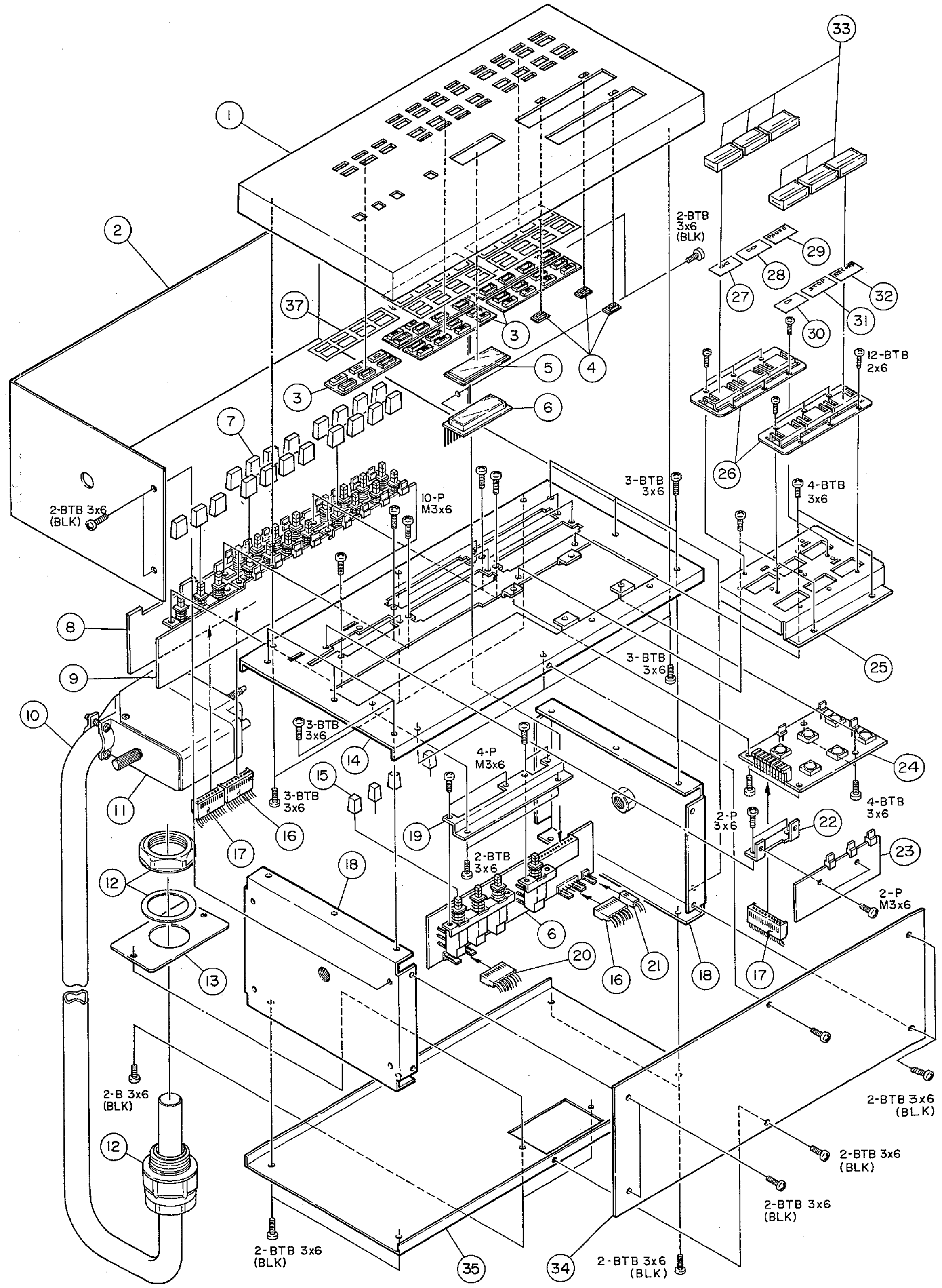
Parts marked with * require longer delivery time.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
1 - 1	*5800449500	Panel, TASCAM	
1 - 2	*5800437400	Button, Push	
1 - 3	*5800340500	Lens, Counter	
1 - 4	*5800449000	Chassis, Control	
1 - 5	*5200999800	PCB Ass'y, DISPLAY	
1 - 6	*5800449300	Chassis, RC	
1 - 7	*5800448900	Bracket, Switch	
1 - 8	*5122172000	Connector, Socket; 10P	
1 - 9	*5122170000	Connector, Socket; 8P	
1 - 10	*5122164000	Connector, Socket; 2P	
1 - 11	*5336149900	Connector, Socket; 9P	
1 - 12	*5200099900	PCB Ass'y, SWITCH	
1 - 13	*5786700400	Lag; $\phi 3$	
1 - 14	*5800448800	Plate, Cable	
1 - 15	*5800437500	Holder, Button; 3	
1 - 16	*5317001600	Bush, Spur-Lock; PG13	
1 - 17	*5350506800	Cable, Remote	
1 - 18	*5334013200	Connector, Plug; 56P	
1 - 19	*5800448700	Slipguard	
1 - 20	*5800449200	Panel, Rear	
1 - 21	*5800341000	Indication Sheet A; PLAY	
1 - 22	*5800341100	Indication Sheet B; STOP	
1 - 23	*5800341200	Indication Sheet C; RECORD	
1 - 24	*5800437200	Indication Sheet FL; REW	
1 - 25	*5800437100	Indication Sheet EL; F. FWD	
1 - 26	*5800437000	Indication Sheet DL; PAUSE	
1 - 27	*5800340700	Cap: A	
1 - 28	*5800366100	Escutcheon, LED	

8-1-6 Remote Control Unit, RC-51
Exploded View–1 (Overall)


①
⑧
2-B M5x10
②
⑧
⑧
①
③
⑧
④
⑤
2-B M5x10
2-B M5x10
⑤
2-B M5x10
2-B M5x10
⑤
⑥
⑤
⑤
⑦
④
④
⑨
⑨
④
⑨
⑨

Exploded View–2 (Unit Section)


㉝
①
②
2-BTB 3x6 (BLK)
㉙
㉘
㉗
㉜
㉛
㉚
㊲
③
④
⑤
③
⑥
12-BTB 2x6
⑦
㉖
10-P M3x6
3-BTB 3x6
4-BTB 3x6
2-BTB 3x6 (BLK)
⑧
⑨
㉕
3-BTB 3x6
⑩
3-BTB 3x6
⑭
4-P M3x6
㉔
⑪
⑮
3-BTB 3x6
⑯
⑰
⑲
2-P 3x6
㉒
4-BTB 3x6
㉓
⑱
2-BTB 3x6
⑫
2-P M3x6
⑥
⑳
⑯
㉑
⑱
⑰
⑬
2-BTB 3x6 (BLK)
2-B 3x6 (BLK)
2-BTB 3x6 (BLK)
⑫
2-BTB 3x6 (BLK)
2-BTB 3x6 (BLK)
㉟
㉞
2-BTB 3x6 (BLK)

Exploded View—1 (Overall)

Parts marked with * require longer delivery time.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
1 - 1	*5800282900	Bolt, Knob	
1 - 2	*5800438400	Holder	
1 - 3	*5800438200	Frame; A	
1 - 4	*5800282500	Cap, End	
1 - 5	*5785225000	Fiber Washer ϕ5 x 10 x t0.5	
1 - 6	*5800449600	Plate, Reinforcement	
1 - 7	*5800438300	Frame: B	
1 - 8	*5800436900	Spacer	
1 - 9	*5740003500	Castor	

Exploded View—2 (Unit Section)

Parts marked with * require longer delivery time.

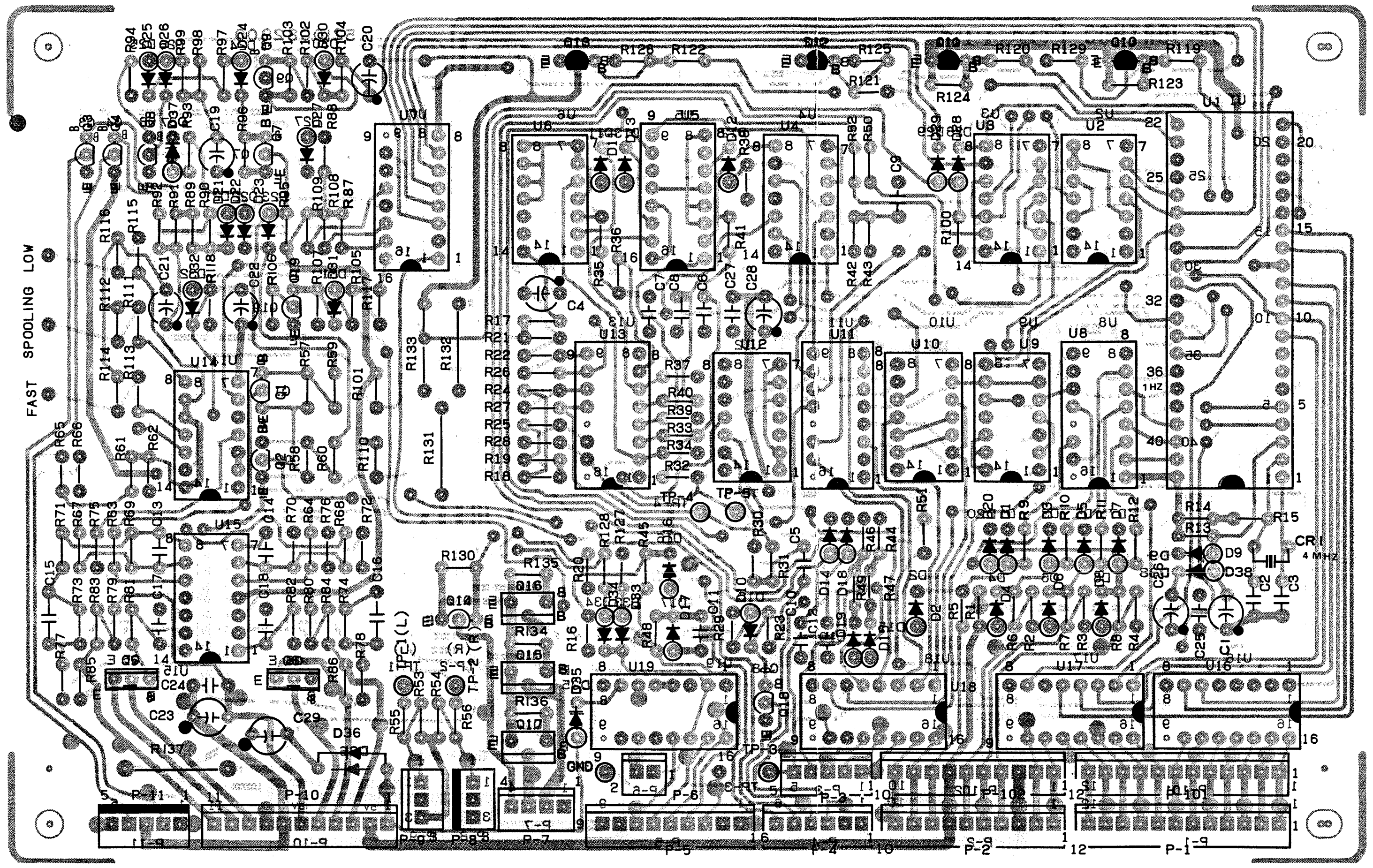
REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
2 - 1	*5800438100	Panel; B	
2 - 2	*5800437700	Cover, Top	
2 - 3	*5800340400	Escutcheon, LED	
2 - 4	*5800366100	Escutcheon, POWER LED	
2 - 5	*5800340500	Lens, Counter	
2 - 6	*5200099800	PCB A'ssy, DISPLAY	
2 - 7	*5800378900	Button	
2 - 8	*5200105200	PCB A'ssy, FUNCTION; A	
2 - 9	*5200105300	PCB A'ssy, FUNCTION; B	
2 - 10	*5350506600	Cable, Remote	
2 - 11	*5334013200	Connector, Plug; 56P	
2 - 12	*5317001400	Bush, Spur-Lock; PG-21	
2 - 13	*5800437300	Plate, Cable	
2 - 14	*5800437900	Chassis	
2 - 15	*5800437400	Button, Push	
2 - 16	*5122170000	Connector, Socket; 8P	
2 - 17	*5336149900	Connector, Socket; 9P	
2 - 18	*5800437800	Chassis, Side	
2 - 19	*5800436700	Bracket, Switch	
2 - 20	*5122172000	Connector, Socket; 10P	
2 - 21	*5122221000	Connector, Socket; 2P	
2 - 22	*5800338300	Bracket, PCB; E	
2 - 23	*5200083000	PCB A'ssy, LED	
2 - 24	*5200099900	PCB A'ssy, SWITCH	
2 - 25	*5800436800	Bracket, PCB	
2 - 26	*5800437500	Holder, Button, 3	
2 - 27	*5800437200	Indication Sheet, FL; REW	
2 - 28	*5800437100	Indication Sheet, EL; F. FWD.	
2 - 29	*5800437000	Indication Sheet, DL; PAUSE	
2 - 30	*5800341000	Indication Sheet, A; PLAY	
2 - 31	*5800341100	Indication Sheet, B; STOP	
2 - 32	*5800341200	Indication Sheet, C; REC	
2 - 33	*5800340700	Cap; A	
2 - 34	*5800438500	Cover, Bottom	
2 - 35	*5800437600	Panel, Rear	
2 - 37	*5800449400	Spacer x 5	

INCLUDED ACCESSORIES (RC-51)

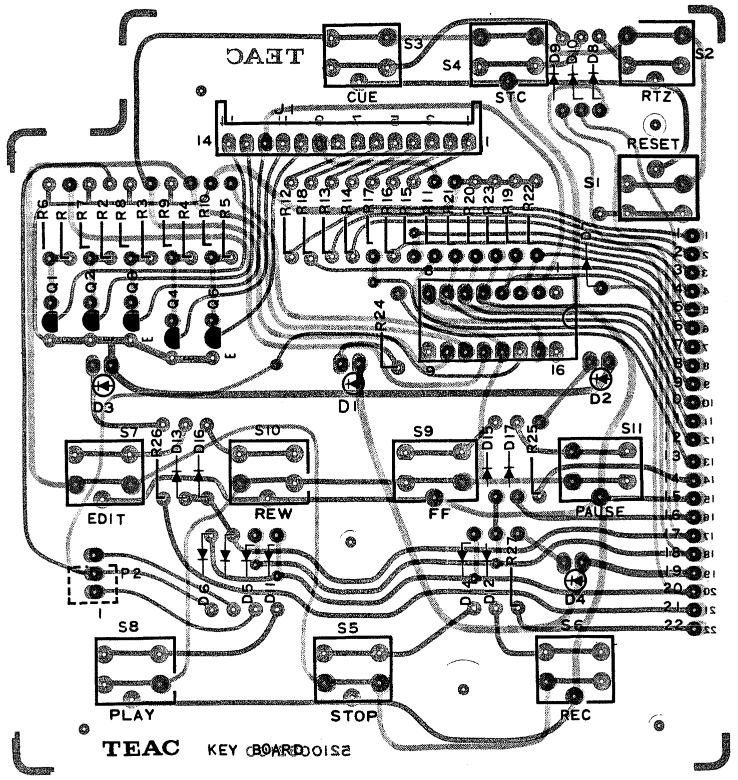
REF. NO.	PARTS NO.	DESCRIPTION
	*5780025010	Screw; B M5 x 10 (BLK Ni) (10 used)
	*5785225000	Washer; Fiber W ϕ5 x ϕ10 x t0.5 (10 used)

8-2. ELECTRONICS – PCB'S AND ELECTRONIC COMPONENTS

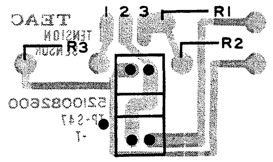
8-2-1. Control PCB Ass'y


FAST SPOOLING LOW
P-1
P-2
P-3
P-4
P-5
P-6
P-7
P-8
P-9
P-10
P-11
TP-1
TP-2
TP-3
TP-4
GND
CR1
4 MHz
1 HZ
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
U18
U19
U20

8-2-2. Keyboard PCB Ass'y


TEAC
S3
S4
S2
CUE
STC
RTZ
RESET
S1
I4
I6
Q1
Q2
Q3
Q4
Q5
D1
D2
D3
D4
S7
S10
S9
S11
EDIT
REW
FF
PAUSE
P2
S8
S5
S6
PLAY
STOP
REC
TEAC KEY BOARD

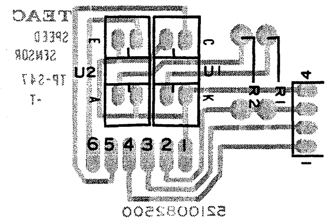
Tension Sensor PCB Ass'y


TEAC
TENSION
1 2 3
R1
R2
R3

Tension Sensor PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200082600	PCB Assy
	5210082600	PCB
U1	5228005300	Photo Interrupter, ON 1108
R1	5180076000	Carbon Resistor 560Ω 5% 1/2W
R2	5181506000	Carbon Resistor 10kΩ 5% 1/4W
R3	5181480000	Carbon Resistor 820Ω 5% 1/4W

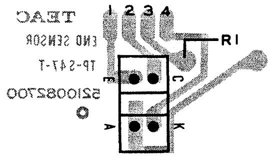
Speed Sensor PCB Ass'y


TEAC
SPEED SENSOR
U2
U1
R1
R2
6 5 4 3 2 1

Speed Sensor PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200082500	PCB Assy
	5210082500	PCB
U1, U2	5228008200	Photo Interrupter, EE-SJB-B
R1, R2	5181462000	Carbon Resistor, 150Ω 5%
P1	5122147000	Connector Plug, 4P

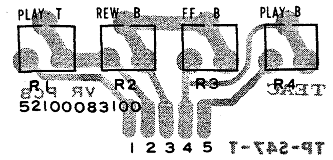
End Sensor PCB Ass'y


TEAC
END SENSOR
1 2 3 4
R1

End Sensor PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200082700	PCB Assy
	5210082700	PCB
U1	5228007500	Photo Interrupter, SJ3W
R1	5181662000	Carbon Resistor 150Ω 5%1/4W

VR PCB Ass'y


PLAY-T
REW-B
FF-B
PLAY-B
R1
R2
R3
R4
TEAC
5210008310
1 2 3 4 5

VR PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200083100	PCB Assy
	5210083100	PCB
		VARIABLE RESISTORS
R1~R4	5280131602	Semi-fixed 2kΩ (B)

Control PCB Ass'y

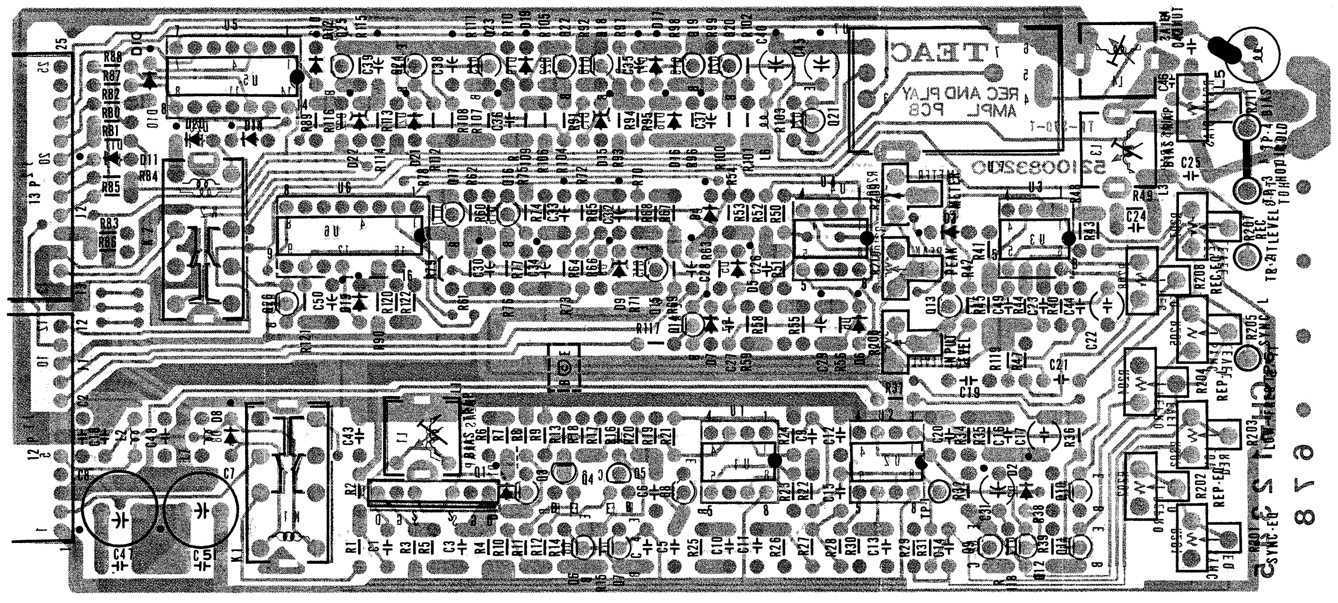
REF. NO.	PARTS NO.	DESCRIPTION
	5200082900	PCB Assy
	5210082900	PCB
	IC'S	
U1	5220803600	MB8841
U2, U3	5220019100	TC4011BP
U4	5220019000	TC4001BP
U5	5220020300	TC4510BP
U6	5220019200	TC4513BP
U7	6048661000	M54517P
U8	5220020000	TC4049BP
U9, U10	5220019100	TC4011BP
U11	5220020000	TC4049BP
U12	5220020200	TC4030BP
U13	5220020100	TC4050BP
U14	5220013400	TC4066BP
U15	6048609000	LM2902
U16~U19	6048661000	M54517P
	TRANSISTORS	
Q1~Q4	5042383000	2SC-536F
Q5, Q6	⚠ 5145077000	2SD-600E
Q7~Q9	5042383000	2SA-536F
Q10~Q13	5042553000	2SA-733P
Q14	5230771000	2SC-227KE
Q15~Q17	5145087000	2SD-313E
Q18, Q19	5042383000	2SC-536F
	DIODES	
D1~D35	5224015010	ISS133HV
D36	5143243000	ERB12-02G1
D37, D38	5224015010	ISS133HV
	CARBON RESISTORS	
	All resistors are rated ±5% tolerance at 1/6 watt.	
R1~R4	5240030020	5.6kΩ
R5~R8	5240028220	1.0kΩ
R9~R12	5240030020	5.6kΩ
R13	5240032220	47kΩ
R14, R15	5240028420	1.2kΩ
R16	5240030620	10kΩ
R17~R19	5240029820	4.7kΩ
R20	5240028200	1.0kΩ
R21, R22	5240030620	10kΩ
R23	5240032220	47kΩ
R24, R25	5240031420	22kΩ
R26~R28	5240035420	1.0MΩ
R29	5240030620	10kΩ
R30	5240031020	15kΩ
R31	5240030020	5.6kΩ
R32	5240031020	15kΩ
R33	5240030020	5.6kΩ
R34	5240035420	1.0MΩ
R35, R36	5240030020	5.6kΩ
R37	5240035420	1.0MΩ
R38	5240031020	15kΩ
R39	5240035420	1.0MΩ
R40	5240030020	5.6kΩ
R41	5240031020	15kΩ
R42	5240030020	5.6kΩ
R43	5240031020	15kΩ
R44~R46	5240030020	5.6kΩ
R47~R49	5240028220	1.0kΩ
R50~R52	5240030020	5.6kΩ
R53, R54	5240032220	47kΩ
R55, R56	5240030620	10kΩ
R57, R58	5240032220	47kΩ
R59, R60	5240030620	10kΩ
R61, R62	5240029220	2.7kΩ
R63, R64	5240030620	10kΩ
R65, R66	5240026620	220Ω
R67, R68	5240030620	10kΩ
R69, R70	5240032220	47kΩ
R71, R72	5240030620	10kΩ
R73, R74	5240034020	270kΩ
R75, R76	5240030620	10kΩ
R77, R78	5240032220	47kΩ
R79, R80	5240031820	33kΩ
R81, R82	5240028220	1.0kΩ
R83, R84	5240029020	2.2kΩ
R85, R86	5240028220	1.0kΩ
R87~R90	5240030620	10kΩ
R91, R92	5240032220	47kΩ
R93	5240031620	27kΩ
R94	5240032220	47kΩ
R95	5240030620	10kΩ
R96	5240032220	47kΩ
R97	5240030620	10kΩ
R98	5240028220	1.0kΩ
R99	5240025820	100Ω
R100, R101	5240031020	15kΩ
R102, R103	5240032220	47kΩ
R104	5240026620	220Ω
R105	5240030620	10kΩ
R106	5240026620	220Ω
R107	5240032220	47kΩ
R108~R110	5240031020	15kΩ
R111	5240031420	22kΩ
R112, R113	5240029820	4.7kΩ
R114	5240028420	1.2kΩ
R115	5240031820	33kΩ
R116	5240031020	15kΩ
R117	5240025220	56kΩ
R118	5240032220	47kΩ
R119~R122	5240031420	22kΩ
R123~R126	5240032220	47kΩ
R127, R128	5240030620	10kΩ
R129	5240028220	1.0kΩ
R130	5240032220	47kΩ
R131~R133	5180062000	150Ω (1/2 W)
R134~R136	5240032220	47kΩ
R137	⚠ 5184755000	100Ω (1W) Nonflammable
	CAPACITORS	
C1	5260162050	Elec. 4.7μF 35V
C2, C3		Refer to MISCELLANEOUS
C4	5260225710	Elec. 0.22μF 50V 10%
C5	5054877500	Mylar 0.01μF 100V 5%
C6	5054896500	Mylar 0.0015μF 100V 5%
C7	5054878500	Mylar 0.001μF 100V 5%
C8, C9	5054891500	Mylar 0.0047μF 100V 5%
C10~C12	5173393000	Ceramic 0.01μF 50V
C13, C14	5054877500	Mylar 0.01μF 100V 5%
C15, C16	5054929500	Mylar 0.12μF 100V 5%
C17, C18	5054877500	Mylar 0.01μF 100V 5%
C19	5260162050	Elec. 4.7μF 35V
C20	5260161150	Elec. 2.2μF 50V
C21	5260160750	Elec. 1μF 50V
C22	5260162500	Elec. 10μF 16V
C23	5260165252	Elec. 47μF 35V
C24, C25	5173393000	Ceramic 0.01μF 50V
C26	5260165252	Elec. 47μF 25V
C27	5173393000	Ceramic 0.01μF 50V
C28	5260165252	Elec. 47μF 25V
C29	5260166852	Elec. 220μF 10V
	CONNECTOR PLUGS	
P1	5122136000	12P
P2	5122134000	10P
P3	5122129000	5P
P4	5122130000	6P
P5	5122133000	9P
P6	5122126000	2P
P7	5122128000	4P
P8	5122300000	3P (RED)
P9	5122127000	3P
P10	5122135000	11P
P11	5122302000	5P (RED)
P101	5122136000	12P
P102	5122134000	10P
	MISCELLANEOUS	
CR1	5347001000	Oscillator, Ceramic KBR4.0M
C2, C3	5172306000	Ceramic 33pF 50V 10%
CR1	5347000800	Oscillator, Ceramic CSA4.00MS
C2, C3	5172312000	Ceramic 100pF 50V 10%

(Either pair can be used)

Keyboard PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200082100	PCB Assy
	5210082100	PCB (PCB, Relay)
	IC	
U1	6048661000	M54517P
	TRANSISTORS	
Q1~Q5	5230016100	2SA-950Y
	DIODES	
D6~D17	5143118000	1S2473HJ
	5225009600	COUNTER,
	CARBON RESISTORS	
	All resistors are rated ±5% tolerance at 1/4 W.	
R1~R5	5181482000	1.0kΩ
R6~R10	5181522000	47kΩ
R11~R18	5181456000	82Ω
R19~R23	5060000000	10kΩ
R24~R26	5181460000	120Ω
R27	5181468000	270Ω
	MISCELLANEOUS	
D1, D2	5225010200	Diode, LED; SLP-255B
D3	5225011300	Diode, LED; SLP-455B
D4	5225010100	Diode, LED; SLP-155B
J1	5336116400	Connector Socket, 14CH
P1	5122366000	Connector Plug, 14AD
S1~S11	5302101600	Switch, Tact

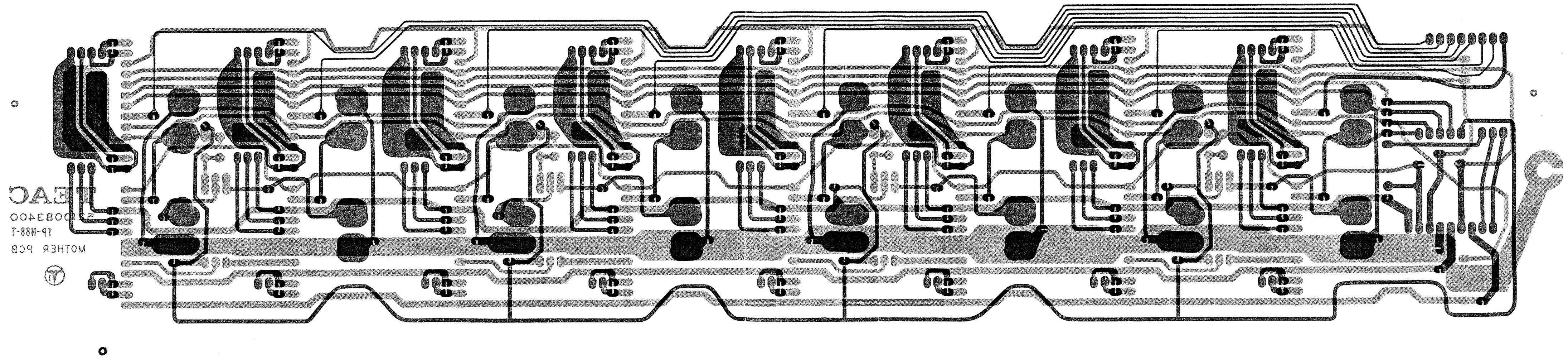
8-2-3. Rec/Play Amplifier PCB Ass'y


TEAC
REC AND PLAY
AMPL PCB

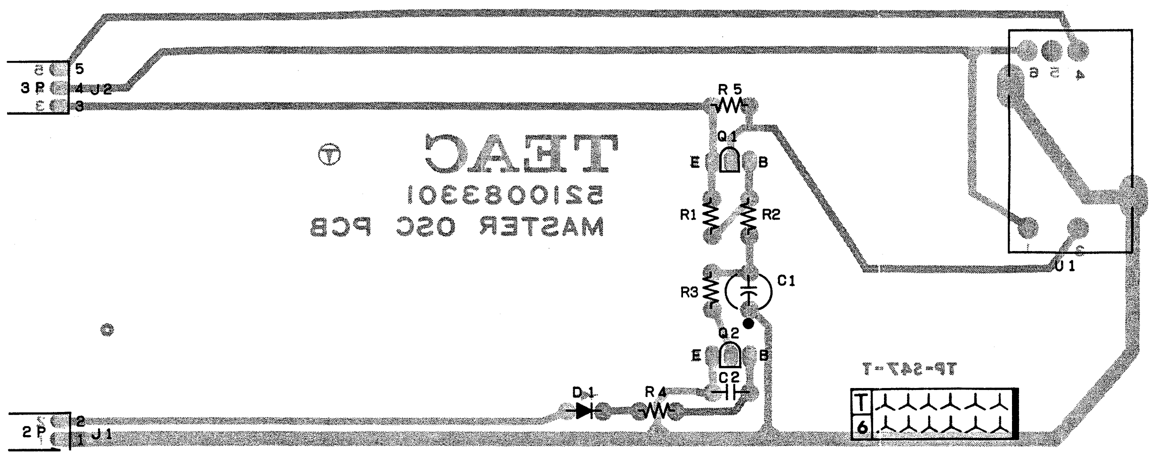
Rec/Play Amplifier PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200083200	PCB Assy
	5210083200	PCB
	IC'S	
U1~U3	5220411600	TL4558P
U4	5220405600	AN6552
U5	5220019000	TC4001BP
U6	5220020000	TC4049BP
U7	5292201800	BIAS Ampl. Module
	TRANSISTORS	
Q1	5232006900	FET, 2SK-270BL
Q3	5145151000	2SC-1815GR
Q4, Q5	5145149000	2SA-970GR
Q6, Q7	5145151000	2SC-1815GR
Q8	5145150000	2SA-1015GR
Q9	5145185000	2SD-655E
Q10, Q11	5145151000	2SC-1815GR
Q12, Q13	5145103000	FET, 2SK-68AM
Q14, Q20	5145151000	2SC-1815GR
Q21	5230771000	2SC-2274K (E)
Q22~Q25	5145151000	2SC-1815GR
	DIODES	
D1~D3	5224015010	1SS133HV
D4, D5	5042213000	IN60
D6~D8	5224015010	1SS133HV
D9	5143154000	EQA01-06S, Zener
D10~D14	5224015010	1SS133HV
D15	5143174000	EQA01-09R, Zener
D16, D17	5224015010	1SS133HV
D19~D21	5224015010	1SS133HV
D22	5143154000	EQA01-06S, Zener
	CARBON RESISTORS **Except for R3, R4, all resistors are rated ±5% tolerance at 1/6 W.**	
R1	5240023420	10Ω
R2	5240030620	10kΩ
R3, R4	5241318200	1.0kΩ Metalized
R5	5240025420	68Ω
R6, R7	5240027020	330Ω
R8	5240028620	1.5kΩ
R9	5240025020	47Ω
R10	5240028020	820Ω
R11, R12	5240025420	68Ω
R13	5240030320	7.5kΩ
R14	5240029220	2.7kΩ
R15	5240028820	1.8kΩ
R16	5240030320	7.5kΩ
R17	5240028620	1.5kΩ
R18, R19	5240024620	33Ω
R20	5240028220	1.0kΩ
R21	5240031020	15kΩ
R22, R23	5240032820	82kΩ
R24	5240027920	750Ω
R25	5240032820	82kΩ
R26	5240027420	470Ω
R27	5240029220	2.7kΩ
R28	5240029620	3.9kΩ
R29	5240030620	10kΩ
R30	5240034420	390kΩ
R31	5240030620	10kΩ
R32	5240029020	2.2kΩ
R34	5240029820	4.7kΩ
R35	5240031620	27kΩ
R36	5240032420	56kΩ
R37	5240027620	560Ω
R38, R39	5240029820	4.7kΩ
R40	5240031600	27kΩ
R41	5240031020	15kΩ
R42	5240029020	2.2kΩ
R43	5240029220	2.7kΩ
R44	5240029420	3.3kΩ
R45	5240032020	39kΩ
R47	5240029420	3.3kΩ
R48	5240027620	560Ω
R49	5240028420	1.2kΩ
R50	5240029420	3.3kΩ
R51	5240033420	150kΩ
R52	5240025820	100Ω
R53	5240029420	3.3kΩ
R54	5240030620	10kΩ
R55	5240031420	22kΩ
R56	5240034820	560kΩ
R58	5240030620	10kΩ
R59	5240028800	1.8kΩ
R60	5240031620	27kΩ
R61, R62	5240032420	56kΩ
R63	5240029420	3.3kΩ
R64	5240031620	27kΩ
R65, R66	5240032420	56kΩ
R67	5240032220	47kΩ
R68	5240031620	27kΩ
R69	5240029020	2.2kΩ
R70	5240030620	10kΩ
R71~R73	5240032220	47kΩ
R74	5240031620	27kΩ
R75	5240030620	10kΩ
R76, R77	5240031620	27kΩ
R78	5240032220	47kΩ
R79	5240031620	27kΩ
R80	5240031020	15kΩ
R81~R85	5240031620	27kΩ
R86~R89	5240031020	15kΩ
R90	5240031620	27kΩ
R91	5240030620	10kΩ
R92	5240032220	47kΩ
R93	5240030620	10kΩ
R94	5240029220	2.7kΩ
R95	5240032220	47kΩ
R96, R97	5240026620	220Ω
R98	5240030620	10kΩ
R99	5240032220	47kΩ
R100, R101	5240030620	10kΩ
R102	5240029020	2.2kΩ
R103	5240023220	8.2Ω
R104	5240031620	27kΩ
R105	5240032220	47kΩ
R106	5240030420	8.2kΩ
R107	5240030820	12kΩ
R108, R109	5240026620	220Ω
R110	5240030620	10kΩ
R111	5240032220	47kΩ
R112	5240030020	5.6kΩ
R113	5240031820	33kΩ
R114	5240026620	220Ω
R115	5240029820	4.7kΩ
R116	5240031620	27kΩ
R117, R118	5240029820	4.7kΩ
	CAPACITORS	
C1	5263106810	Polyst. 390pF 100V 5%
C2	5054878500	Mylar 0.001μF 100V 5%
C3	5172318000	Ceramic 330pF 50V 10%
C4, C5	5172304000	Ceramic 22pF 50V 10%
C6	5263107610	Polyst. 820pF 100V 5%
C7	5173055800	Elec. 220μF 25V
C8	5173073000	Elec. 470μF 25V
C9	5260253010	Elec. (B.P) 3.3μF 25V 20%
C10	5054899500	Mylar 0.027μF 100V 5%
C11, C12	5054878500	Mylar 0.001μF 100V 5%
C13	5054928500	Mylar 0.1μF 100V 5%
C14	5260250910	Elec. (B.P) 0.22μF 50V 20%
C15	5054878500	Mylar 0.001μF 100V 5%
C16	5172307000	Ceramic 39pF 50V 10%
C17	5260067050	Elec. (B.P) 10μF 16V 20%
C18	5054727500	Mylar 0.0036μF 100V 5%
C19	5260065650	Elec. (B.P) 1μF 50V 20%
C21	5054891500	Mylar 0.0047μF 100V 5%
C22	5260067850	Elec. (B.P) 22μF 16V 20%
C23	5263106610	Polyst. 330pF 100V 5%
C24	5054890500	Mylar 0.0039μF 100V 5%
C25	5263106810	Polyst. 390pF 100V 5%
C26	5260067050	Elec. 10μF 16V 20%
C27	5054878500	Mylar 0.001μF 100V 5%
C28	5260165052	Elec. 47μF 10V 20%
C29	5260160750	Elec. 1μF 50V 20%
C30~C34	5260162050	Elec. 4.7μF 25V 20%
C35, C36	5171912000	Elec. 0.22μF 50V 20%
C37~C39	5260163452	Elec. 22μF 25V 20%
C40	5173029000	Elec. 33μF 35V
C42	5263105410	Polyst. 100pF 100V 5%
C43	5263107610	Polyst. 820pF 100V 5%
C44	5054878500	Mylar 0.001μF 100V 5%
C45	5260160750	Elec. 1μF 50V 20%
C46	5054878500	Mylar 0.001μF 100V 5%
C48	5054878500	Mylar 0.001μF 100V 5%
C49	5054889500	Mylar 0.0027μF 100V 5%
	VARIABLE RESISTORS	
R201, R202	5280131602	Semi-fixed 2kΩ (B)
R203	5280132702	Semi-fixed 50kΩ (B)
R204, R205	5280132002	Semi-fixed 5kΩ (B)
R206	5280131602	Semi-fixed 2kΩ (B)
R207, R208	5280132002	Semi-fixed 5kΩ (B)
R209~R211	5280132702	Semi-fixed 50kΩ (B)
	COILS	
L1	5160044000	Trap 3mH 20%
L2	5160100000	Choke 330μH 10%
L3	5160044000	Trap 3mH 20%
L4	5286011400	Choke 1.3mH
L5	5286011500	Choke 200μH
L6, L7	5160107000	Choke 1200μH 5%
	MISCELLANEOUS	
K1, K2	5290009400	Relay; 24V, G2V-282P
J1	5122383000	Connector Socket, 12P
J2	5122384000	Connector Socket, 13P
TP1~TP5	5317001200	Pin φ0.7
	5800303900	Case, Shield

8-2-4. Mother PCB Ass'y


TEAC
5100083400
TP-N88-T
MOTHER PCB

Master Oscillator PCB Ass'y


5
3P
3
4 J2
TEAC
5210083301
MASTER OSC PCB
R5
Q1
E
B
R1
R2
R3
C1
Q2
C2
D1
R4
2P
2
1 J1
U1
TP-S47-T
T
6

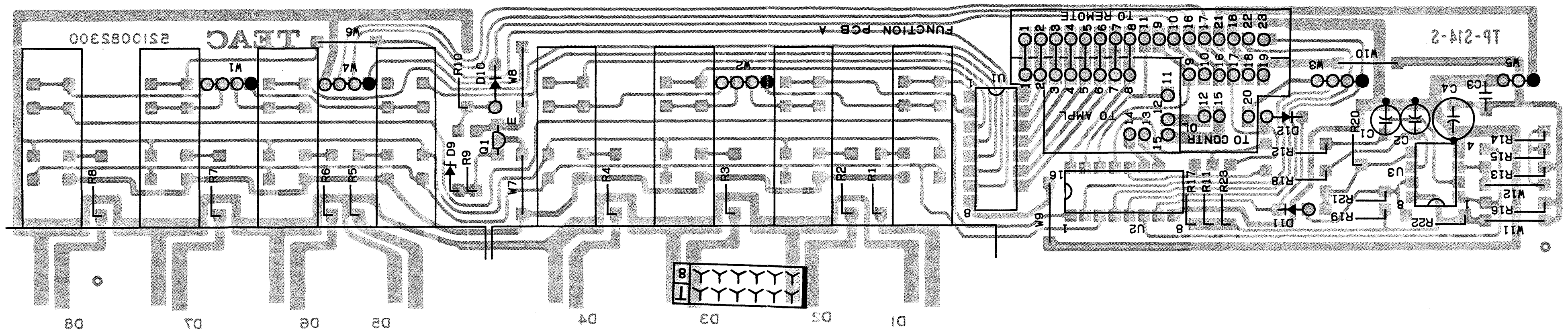
Mother PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200083400	PCB Assy
	5210083400	PCB
D1~D4	5042517000	Diode, IS2473VE
K1~K4	5061137000	Reed Relay, 12V LAB2L
R1~R4	5240168400	Carbon Resistor, 1.2kΩ 5%
R5	⚠ 5184235000	Carbon Resistor, 27Ω 5% nonflammable
J1~J8	5330507400	Pin Jack, 2P
		CONNECTOR PLUGS
P101, P201	5122364000	12P
P301, P401	5122364000	12P
P501, P601	5122364000	12P
P701, P801	5122364000	12P
P102, P202	5122365000	13P
P302, P402	5122365000	13P
P502, P602	5122365000	13P
P702, P802	5122365000	13P
P103, P203	5122147000	4P
P303, P403	5122147000	4P
P503, P603	5122147000	4P
P703, P803	5122147000	4P
P104, P204	5122146000	3P
P304, P404	5122146000	3P
P504, P604	5122146000	3P
P704, P804	5122146000	3P
P105, P205	5122145000	2P
P305, P405	5122145000	2P
P505, P605	5122145000	2P
P705, P805	5122145000	2P
P901	5122364000	2P
P902	5122355000	3P
P903	5122151000	8P
P904	5122148000	5P
P905	5122454000	3P
P906	5122152000	9P

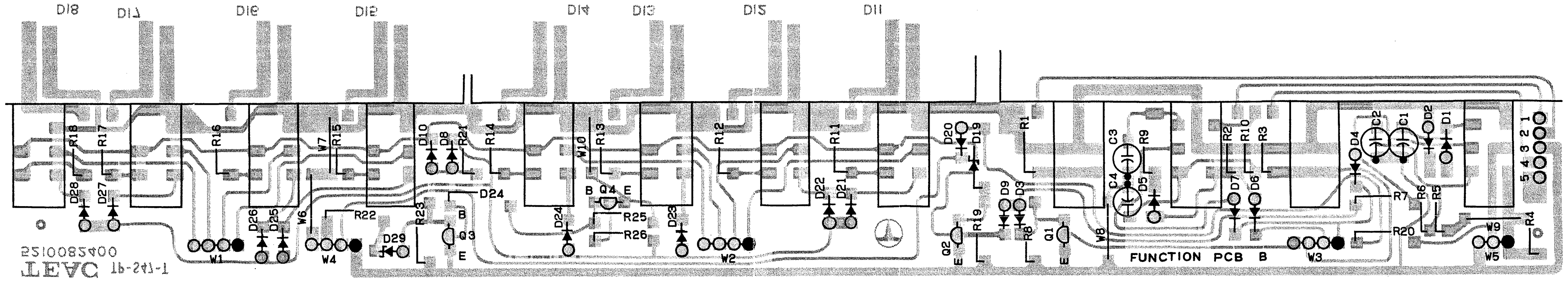
Master Oscillator PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200083300	PCB Assy
	5210083301	PCB
		TRANSISTORS
Q1	5145150000	2SA-1015GR
Q2	5145151000	2SC-1815GR
		CARBON RESISTORS
		All resistors are rated ±5% tolerance at 1/4 watt.
R1	5240170600	10kΩ
R2	5240170200	6.8kΩ
R3	5240171400	22kΩ
R4	5240170600	10kΩ
R5	5240169000	2.2kΩ
R6	5240170600	10kΩ
		MISCELLANEOUS
U1	5292201900	OSC Unit, 145kHz
D1	5042517000	Diode, 1S2473VE
C1	5260163452	Capacitor, Elec. 22μF 25V
J1	5122373000	Connector Socket, 2P
J2	5122374000	Connector Socket, 3P

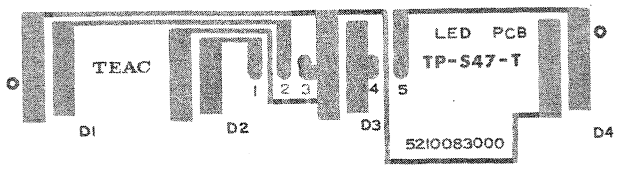
8-2-5. Function A PCB Ass'y


TEAC
5210082300
FUNCTION PCB A
TO REMOTE
TO AMPL
TO CONTR
TP-214-2
U1
U2
U3
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
Q1
C1
C2
C3
C4
W1
W2
W3
W4
W5
W6
W7
W8
W9
W10
W11
W12

Function B PCB Ass'y


D18
D17
D16
D15
D14
D13
D12
D11
5210082400
TEAC
FUNCTION PCB B
Q1
Q2
Q3
Q4
C1
C2
C3
C4
W1
W2
W3
W4
W5
W6
W7
W8
W9
W10
5 4 3 2 1

LED PCB Ass'y


TEAC
LED PCB
TP-S47-T
5210083000
1
2
3
4
5
D1
D2
D3
D4

(Viewed from foil side)

Function A PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200082300	PCB Assy
	5210082300	PCB
	IC'S	
U1, U2	6048661000	M54517P
U3	5220012500	μPC 393C
	TRANSISTORS	
Q1	5230771000	2SC2274K (E)
	DIODES	
D9	5224539901	RD4.7 EB, Zener
D10~D12	5042517000	1S2473VE
	CARBON RESISTORS	
	All resistors are rated ±5% tolerance at 1/4 W.	
R1~R8	5184992000	2.7kΩ
R9	5181522000	47kΩ
R10	5181484000	1.2kΩ
R11	5181492000	2.7kΩ
R12	5181522000	47kΩ
R13	5181524000	56kΩ
R14	5181530000	100kΩ
R15	5181518000	33kΩ
R16	5181498000	4.7kΩ
R17	5181540000	270kΩ
R18	5181458000	100Ω
R19	5181518000	33kΩ
R20, R21	5181530000	100kΩ
R22	5181498000	4.7kΩ
R23	5181484000	1.2kΩ
	CAPACITORS	
C1, C2	5260226110	Elec. 1.0μF 50V 10%
C3	5173393000	Ceramic 0.01μF 50V 10%
C4	5260165252	Elec. 47μF 25V
	MISCELLANEOUS	
D1~D8	5225010100	Diode; LED; SLP-155B
S1, S2	5300028900	Push-Switch, 4-gang

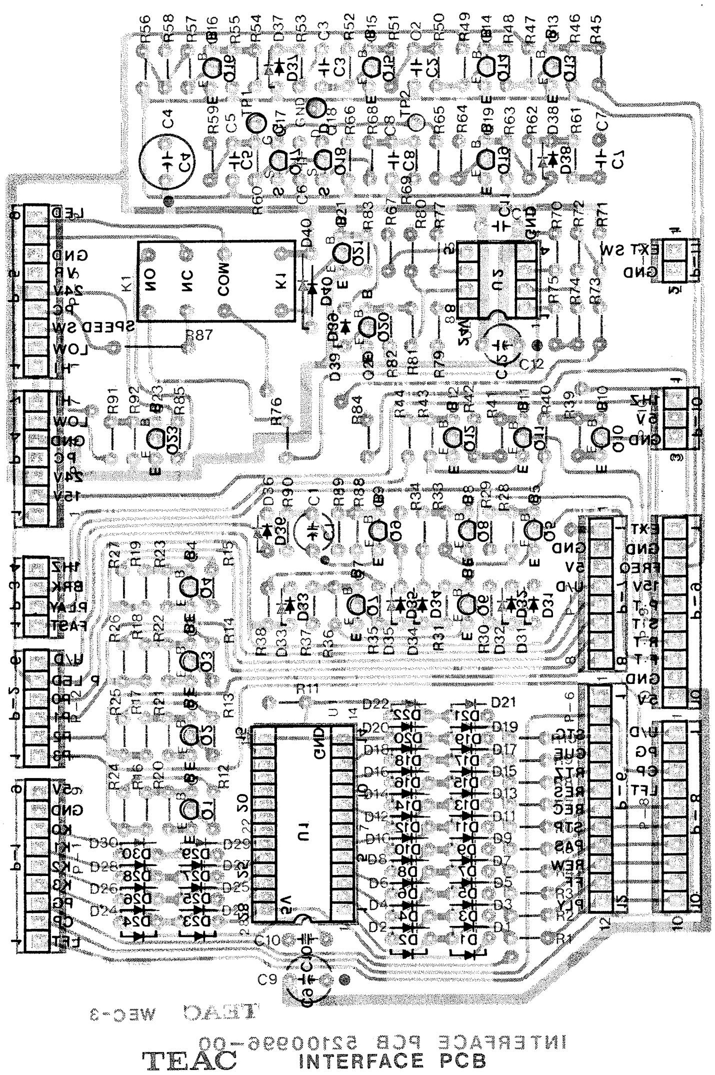
Function B PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200082400	PCB Assy
	5210082400	PCB
	TRANSISTORS	
Q1	5042383000	2SC-536F
Q2	5230771000	2SC-2274K (E)
Q3	5042383000	2SC-536F
Q4	5042553000	2SA-733P
	DIODES	
D1~D10,	5042517000	1S2473VE
D20~D28	5042517000	1S2473VE
D19, D29	5224531501	RD4.7EB1, Zener
	CARBON RESISTORS	
	All resistors are rated ±5% tolerance at 1/4 W.	
R1	5181478000	680Ω
R2	5181480000	820Ω
R3, R4	5181492000	2.7kΩ
R5, R6	5181458000	100Ω
R7	5781506000	10kΩ
R8	5181522000	47kΩ
R9, R10	5181458000	100Ω
R11~R18	5181480000	820Ω
R19	5181522000	47kΩ
R20, R21	5181484000	1.2kΩ
R22	5181506000	10kΩ
R23	5181522000	47kΩ
R24	5181516000	27kΩ
R25	5181522000	47kΩ
R26	5181484000	1.2kΩ
	CAPACITORS	
C1, C2	5260162050	Elec. 4.7μF 35V
C3, C4	5260160750	Elec. 1μF 50V
	MISCELLANEOUS	
S1	5300029000	Push-Switch
S2	5300028000	Push-Switch; 3-gang
S3, S4	5300028800	Push-Switch; 4-gang
D11~D18	5225011300	Diode, LED; SLP455B

LED PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200083000	PCB Assy
	5210083000	PCB
D1	5225010200	Diode, LED; SLP-255B
D2	5225011300	Diode, LED; SLP-455B
D3, D4	5225010100	Diode, LED; SLP-155B

8-2-6. Interface PCB Ass'y

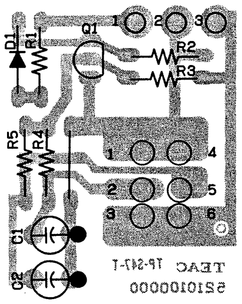

TEAC
INTERFACE PCB
K1
U1
U2
C4
C9
C10
C12

Interface PCB Ass'y

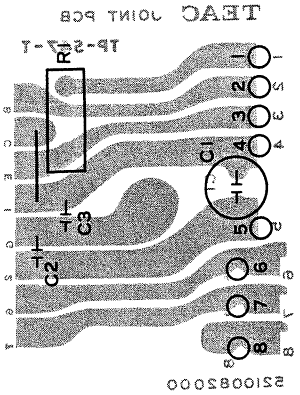
REF. NO.	PARTS NO.	DESCRIPTION
	5200099600	PCB Assy
	5210099600	PCB
	IC'S	
U1	5220019700	LC7800
U2	5220407200	LM2904
	TRANSISTORS	
Q1~Q16	5042383000	2SC536(F)
Q17	6048071000	2N5462
Q18	5145103000	2SK68A-M
Q19~Q21	5042383000	2SC536(F)
	DIODES	
D1~D39	5224015010	1SS133HV
D40	5143243000	EBR12-02G1
D41	5760216400	HZ3C1
	CARBON RESISTORS	
All resistors are rated ±5% tolerance at 1/6 watt.		
R1~ R10	5240028220	1kΩ
R12~R19	5240030620	10kΩ
R20~R23	5240032220	47kΩ
R24~R27	5240030620	10kΩ
R28	5240032220	47kΩ
R29~R31	5240030620	10kΩ
R33	5240032220	47kΩ
R34, R35	5240030620	10kΩ
R36	5240032220	47kΩ
R38	5240030620	10kΩ
R39	5240032220	47kΩ
R40~R42	5240030620	10kΩ
R43	5240032220	47kΩ
R44, R45	5240030620	10kΩ
R46	5240032220	47kΩ
R47	5240031020	15kΩ
R48	5240031420	22kΩ
R49	5240033820	220kΩ
R50, R51	5240031420	22kΩ
R52	5240031020	15kΩ
R53	5240027020	330Ω
R54	5240030620	10kΩ
R55	5240032220	47kΩ
R56	5240030620	10kΩ
R57	5240031820	33kΩ
R58	5240030620	10kΩ
R59~R61	5240027020	330Ω
R62	5240031420	22kΩ
R63	5240032220	47kΩ
R64	5240030620	10kΩ

REF. NO.	PARTS NO.	DESCRIPTION		
R65	5240033020	100kΩ		
R66	5240030020	5.6kΩ		
R67~R69	5240030620	10kΩ		
R70	5240032220	47kΩ		
R71, R72	5240030620	10kΩ		
R73	5240026020	120Ω		
R74	5240031820	33kΩ		
R75	5240031220	18kΩ		
R76	5240029820	4.7kΩ		
R77	5240030620	10kΩ		
R79	5240029220	2.7kΩ		
R80	5240035420	1MΩ		
R81~R83	5240032220	47kΩ		
R84, R85	5240030620	10kΩ		
R87	5185548000	12kΩ, Metalized		
R88	5240032220	47kΩ		
R89	5240030620	10kΩ		
R90	5240026020	120Ω		
	CAPACITORS			
C1	5260160550	Elec.	0.47µF	50V
C2	5172321000	Ceramic	560pF	
C3	5172316000	Ceramic	220pF	
C4	5260166152	Elec.	100µF	25V
C5	5054877500	Myler	0.01µF	
C6	5054881500	Myler	0.0035µF	
C7	5172309000	Ceramic	56pF	
C8	5054877500	Myler	0.01µF	
C9	5260165352	Elec.	47µF	35V
C10, C11	5173393000	Ceramic	0.01µF	
C12	5260165352	Elec.	47µF	35V
	MISCELLANEOUS			
K1	5290009400	Relay, G2V-292P		
P1	5122306000	Connector Plug, 9P (RED)		
P2	5122130000	Connector Plug, 6P (WHT)		
P3	5122128000	Connector Plug, 4P (WHT)		
P4	5122131000	Connector Plug, 7P (WHT)		
P5	5122133000	Connector Plug, 9P (WHT)		
P6	5122309000	Connector Plug, 12P (RED)		
P7	5122132000	Connector Plug, 8P (WHT)		
P8	5122134000	Connector Plug, 10P (WHT)		
P9	5122307000	Connector Plug, 10P (RED)		
P10	5122127000	Connector Plug, 3P (WHT)		
P11	5122126000	Connector Plug, 2P (WHT)		
	5544750000	Pin, Combination (3 used)		

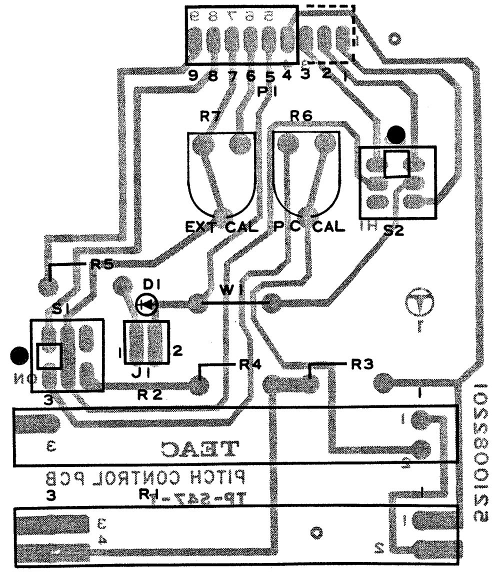
8-2-7. Connector PCB Ass'y


D1
R1
Q1
1
2
3
R2
R3
R5
R4
1
4
2
5
3
6
C1
C2

Joint PCB Ass'y


R1
1
2
3
4
C1
C3
5
C2
6
7
8

Pitch Control PCB Ass'y


9
8
7
6
5
4
3
2
1
P1
R7
R6
EXT
CAL
P C
CAL
S2
R5
D1
W1
S1
1
2
J1
R4
R3
R2
3
1
2
3
R1
1
3
4
2

Connector PCB Ass'y

REF.	PARTS NO.	DESCRIPTION
	5210108000	Connector PCB
	5210100000	PCB
Q1	5145151000	Transistor 2SC1815GR
D1	5143118000	Diode 1S2473HJ
R1	5181528000	Carbon Resistor R25 82kΩ
R2	5181522000	Carbon Resistor R25 47kΩ
R3	5181482000	Carbon Resistor R25 1kΩ
R4, R5	5181498000	Carbon Resistor R25 4.7kΩ
C1, C2	5260162050	Capacitor, Elec. 4.7μF 35V

Head PCB Ass'y (PCB Omitted)

REF. NO.	PARTS NO.	DESCRIPTION
	5200088600	PCB Assy
	5210088600	PCB
J1~J3	5332014000	Socket, IC, 16P

Fuse PCB Ass'y (PCB Omitted)

REF. NO.	PARTS NO.	DESCRIPTION
	5200081800	PCB Assy [U, C, GE, J]
	5200081810	PCB Assy [E, UK, A]
	5210081800	PCB [U, C, GE, J]
	5210081900	PCB [E, UK, A]
	FUSES	
F1~F3	⚠ 5307004100	2A 250V [U, C, GE, J]
F4	⚠ 5307004300	3A 250V [U, C, GE, J]
F5~F7	⚠ 5307004700	7A 125V [U, C, GE, J]
F1~F3	⚠ 5142189000	T2A 250V, mini [E, UK, A]
F4	⚠ 5142191000	T3.15A 250V, mini [E, UK, A]
F5~F7	⚠ 5142193000	T5A 250V, mini [E, UK, A]
	MISCELLANEOUS	
	5041237000	Holder, Fuse [U, C, GE, J]
	5332014200	Holder, Fuse [E, UK, A]

Pitch Control PCB Ass'y

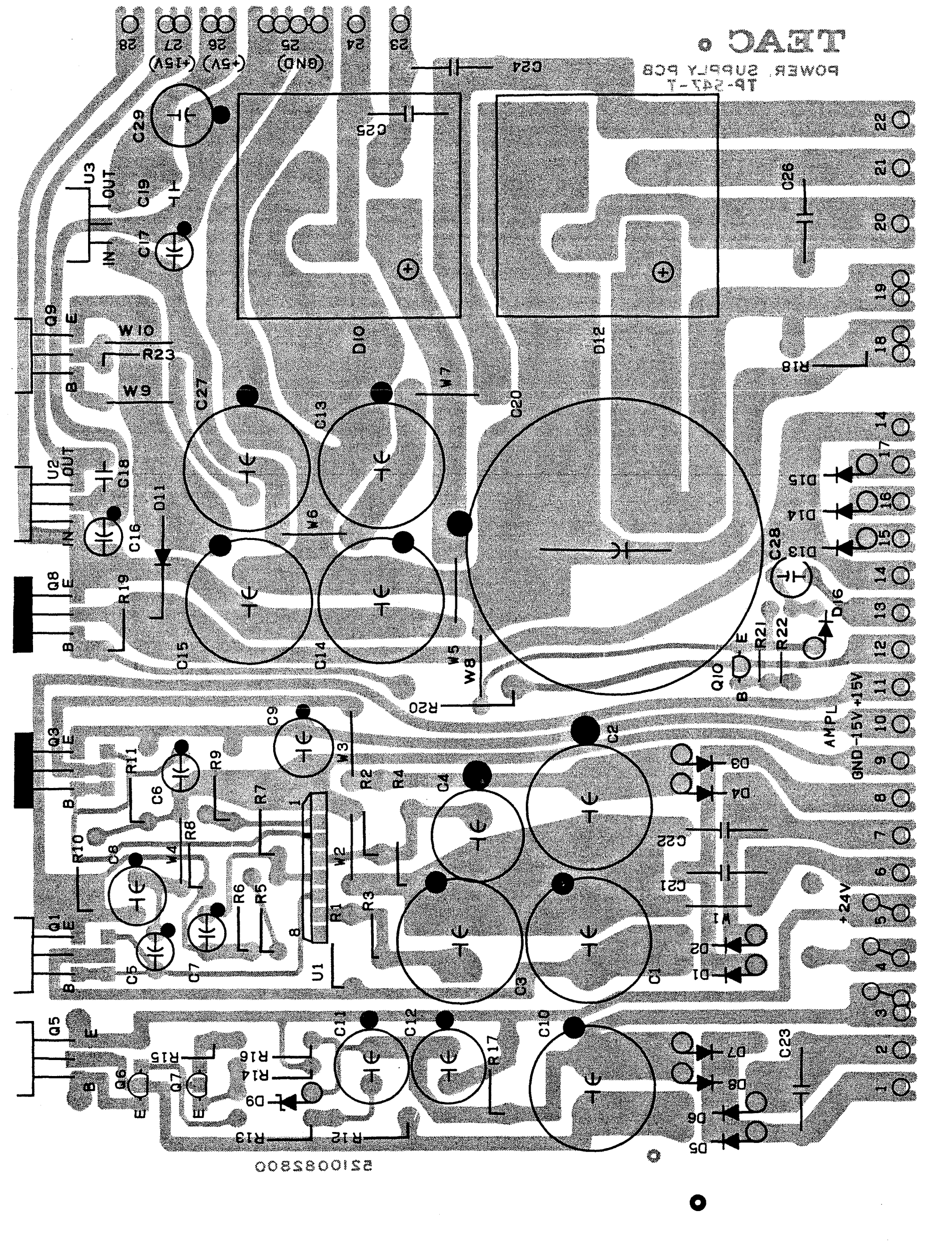
REF. NO.	PARTS NO.	DESCRIPTION
	5200082201	PCB Assy
	5210082201	PCB
	CARBON RESISTORS **All resistors are rated ±5% tolerance at 1/4 W.**	
R3	5183112000	18kΩ
R4	5181478000	680Ω
R5	5181496000	3.9kΩ
	VARIABLE RESISTORS	
R1	5284006000	Semi-fixed, Slide: 20kΩ (B)
R2	5284006100	Semi-fixed, Slide: 1kΩ (B)
R6, R7	5150265010	Semi-fixed, 500Ω (B)
	MISCELLANEOUS	
D1	5225007900	Diode, LED; GL-9PR2
P1	5122152000	Connector Plug; 9P
J1	5336115200	Connector Socket; 2P
S1	5300025700	Push-Switch; 2-2

Joint PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION
	5200082000	PCB Assy
	5210082000	PCB (PCB, Transistor)
R1	⚠ 5241262100	Resistor, Metal Plate 0.15Ω(5W)10%
C1	5260067610	Capacitor, Elec. 10μF 100V 20%
C2, C3	5173393000	Capacitor, Ceramic 0.01μF 50V

[U]: U.S.A.
[C]: CANADA
[GE]: GENERAL EXPORT
[A]: AUSTRALIA
[E]: EUROPE
[UK]: U.K.
[L]: LIMITED AREA
[J]: JAPAN

8-2-8. Power Supply PCB Ass'y


TEAC
POWER SUPPLY PCB
TP-547-T
28
27 (+15V)
26 (+5V)
25 (GND)
24
23
C24
C25
C26
C29
U3
OUT
IN
C19
C17
Q9
E
B
W10
R23
W9
C27
D10
D12
W7
C20
C13
U2
OUT
IN
C18
C16
D11
Q8
R19
C15
C14
W6
W5
W8
R20
R18
D15
D14
D13
C28
D16
Q10
R21
R22
Q3
R11
C6
R9
C9
W3
R2
R4
C4
C2
D3
D4
C22
C21
W1
D2
D1
Q1
R10
C8
W4
R8
R7
R6
R5
R1
R3
U1
C5
C7
C3
C1
Q5
Q6
Q7
R15
R16
R14
D9
C11
C12
R17
C10
D7
D8
D6
D5
C23
R13
R12
5210082800
AMPL
GND
-15V
+15V
+24V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

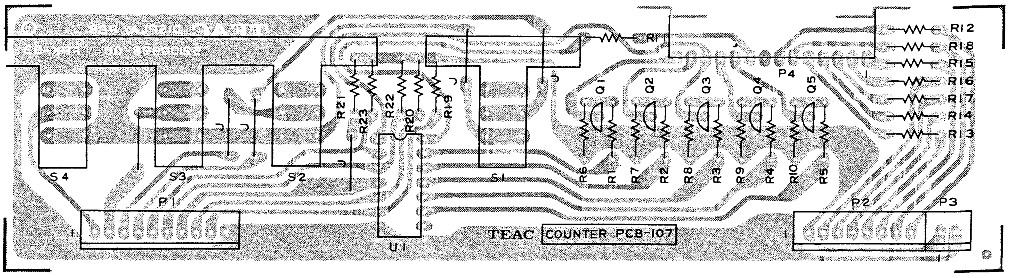
Power Supply PCB Ass'y

REF. NO.	PARTS NO.	DESCRIPTION			
	5200082800	PCB Assy			
	5210082800	PCB			
	IC'S				
U1	⚠ 5220416400	M5230L			
U2	⚠ 5220415600	NJM7815A			
U3	⚠ 5220415100	NJM7805A			
	TRANSISTORS				
Q1	⚠ 5145087000	2SD-313E			
Q3	⚠ 5145129000	2SB-507E			
Q5, Q9	⚠ 5145087000	2SD-313E			
Q6, Q10	⚠ 5230771000	2SC-2274K (E)			
Q7	5042383000	2SC-536F			
Q8	⚠ 5145129000	2SB-507E			
	DIODES				
D1~D8	⚠ 5143243000	ERB12-02G1			
D9	5143154000	EQA01-06S, Zener			
D10	⚠ 5228007300	D5FB20, Silicon Stad			
D11	⚠ 5224014700	S3V20H			
D12	⚠ 5228007300	D5FB20, Silicon Stad			
D13~D15	5143243000	ERB12-02G1			
	CARBON RESISTORS **All resistors are rated ±5% tolerance at 1/4 W, unless otherwise indicated**				
R1, R2	⚠ 5184257000	220Ω	Nonflammable		
R3, R4	5181490000	2.2kΩ			
R5	5181514000	22kΩ			
R6	5181490000	2.2kΩ			
R7	5181494000	3.3kΩ			
R8, R9	5181510000	15kΩ			
R10, R11			Not applicable		
R12	5181502000	6.8kΩ			
R13	5181506000	10kΩ			
R14	5181496000	3.9kΩ			
R15	5181512000	18kΩ			
R16	5181502000	6.8kΩ			
R17			Not applicable		
R18	5181506000	10kΩ			
R19	5181494000	3.3kΩ			
R20	⚠ 5184763000	220Ω	(1W) Nonflammable		
R21	5181522000	47kΩ			
R22	5181506000	10kΩ			
R23	⚠ 5184229000	15Ω	Nonflammable		
	CAPACITORS				
C1, C2	⚠ 5173079000	Elec.	2200µF	35V	
C3	⚠ 5173083000	Elec.	1000µF	35V	
C4	⚠ 5173065000	Elec.	330µF	35V	
C5, C6	5260160550	Elec.	0.47µF	50V	
C7~C9	5260165252	Elec.	47µF	25V	
C10	⚠ 5173084000	Elec.	1000µF	50V	
C11	5173047800	Elec.	100µF	35V	
C12	5173056800	Elec.	220µF	35V	
C13	⚠ 5173094000	Elec.	3300µF	25V	
C14, C15	⚠ 5262002300	Elec.	2200µF	50V	

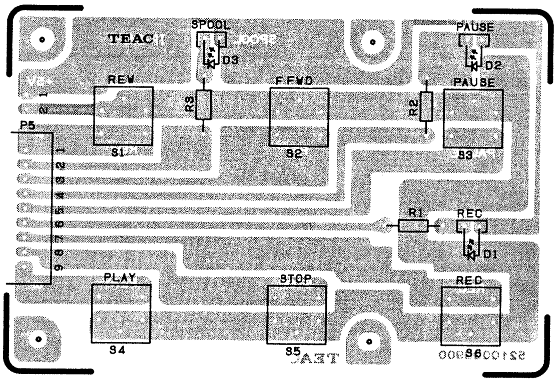
REF. NO.	PARTS NO.	DESCRIPTION			
C16, C17	5172882000	Elec.	1µF	50V	
C18, C19	5054928500	Mylar	0.1µF	100V	5%
C20	⚠ 5262002200	Elec.	6800µF	50V	BK50-LISN
C21~C26	5263164500	Metalized	0.047µF	250V	10%
C27	⚠ 5173094000	Elec.	3300µF	25V	
C28	5260162650	Elec.	10µF	25V	
C29	5173070000	Elec.	470µF	6.3V	
	MISCELLANEOUS				
	5033291000	Plate, Insulating			
	5033295000	Tube, Insulating			

8-2-9 RC-50 and RC-51 PCB Ass'y

Display PCB Ass'y


RI1
RI2
RI8
RI5
RI6
RI7
RI4
RI3
P4
Q1
Q2
Q3
Q4
Q5
R21
R23
R22
R20
R19
R6
R1
R7
R2
R8
R3
R9
R4
R10
R5
S4
S3
S2
S1
P1
U1
TEAC
COUNTER PCB-107
P2
P3

Switch PCB Ass'y


TEAC
SPOOL
D3
PAUSE
D2
REW
F FWD
PAUSE
R3
R2
P5
S1
S2
S3
R1
REC
D1
REC
PLAY
STOP
S4
S5

DISPLAY PCB ASS'Y (RC-50/RC-51)

REF. NO	PARTS NO.	DESCRIPTION
	5200099800	PCB Ass'y
	5210099800	PCB
	IC	
UI	6048661000	M54517P
	TRANSISTORS	
Q1 ~ Q5	5230016100	2SA950Y
	CARBON RESISTORS **All resistors are rated ±5% tolerance at 1/4 watt.**	
R1 ~ R5	5183082000	1kΩ
R6 ~ R10	5183122000	47kΩ
R11 ~ R18	5183056000	82kΩ
R19 ~ R23	5183106000	10kΩ
	PUSH SWITCHES	
S1	5300031200	SUN 1 - 2
S2	5300031300	SUN 3 - 2
	MISCELLANEOUS	
P1	5122134000	Connector, Plug; 10P
P2	5122132000	Connector, Plug; 8P
P3	5122126000	Connector, Plug; 2P
P4	5122366000	Connector, Plug; 14P
J4	5122378500	Connector, Socket; 14P
	5225009600	Counter

SWITCH PCB Ass'y (RC-50/RC-51)

REF. NO	PARTS NO.	DESCRIPTION
	5200099900	PCB Ass'y
	5210099900	PCB
	CARBON RESISTORS **All resistors are rated ±5% tolerance at 1/4 watt.**	
R1	5183068000	270Ω
R2, R3	5183060000	120Ω
	LED'S	
D1	5225010100	SLP-155B
D2, D3	5225010200	SLP-255B
	MISCELLANEOUS	
	5302101600	Switch, Tact (6 used)
P5	6052380009	Connector, Bottom Entry; 9P

FUNCTION A PCB Ass'y (RC-51 only)

REF. NO	PARTS NO.	DESCRIPTION
	5200105200	PCB Ass'y
	5210082300	PCB
	IC'S	
U1, U2	6048661000	M54517P
	TRANSISTOR	
Q1	5230771000	2SC2274K(E)
	DIODES	
D9	5224531501	RD417ED, Zener
D10	5042517000	IS2473VE
	CARBON RESISTORS	
All resistors are rated ±5% tolerance at 1/4 watt.		
R1 ~R8	5183092000	2.7kΩ
R9	5183122000	47kΩ
R10	5183084000	1.2kΩ
	MISCELLANEOUS	
S1, S2	5300028900	Push Switch, 4-2
D1 ~D8	5225010100	LED, SLD-155B (RED)
P6	5122151000	Connector, Plug; 8P
P7	5122152000	Connector, Plug; 9P

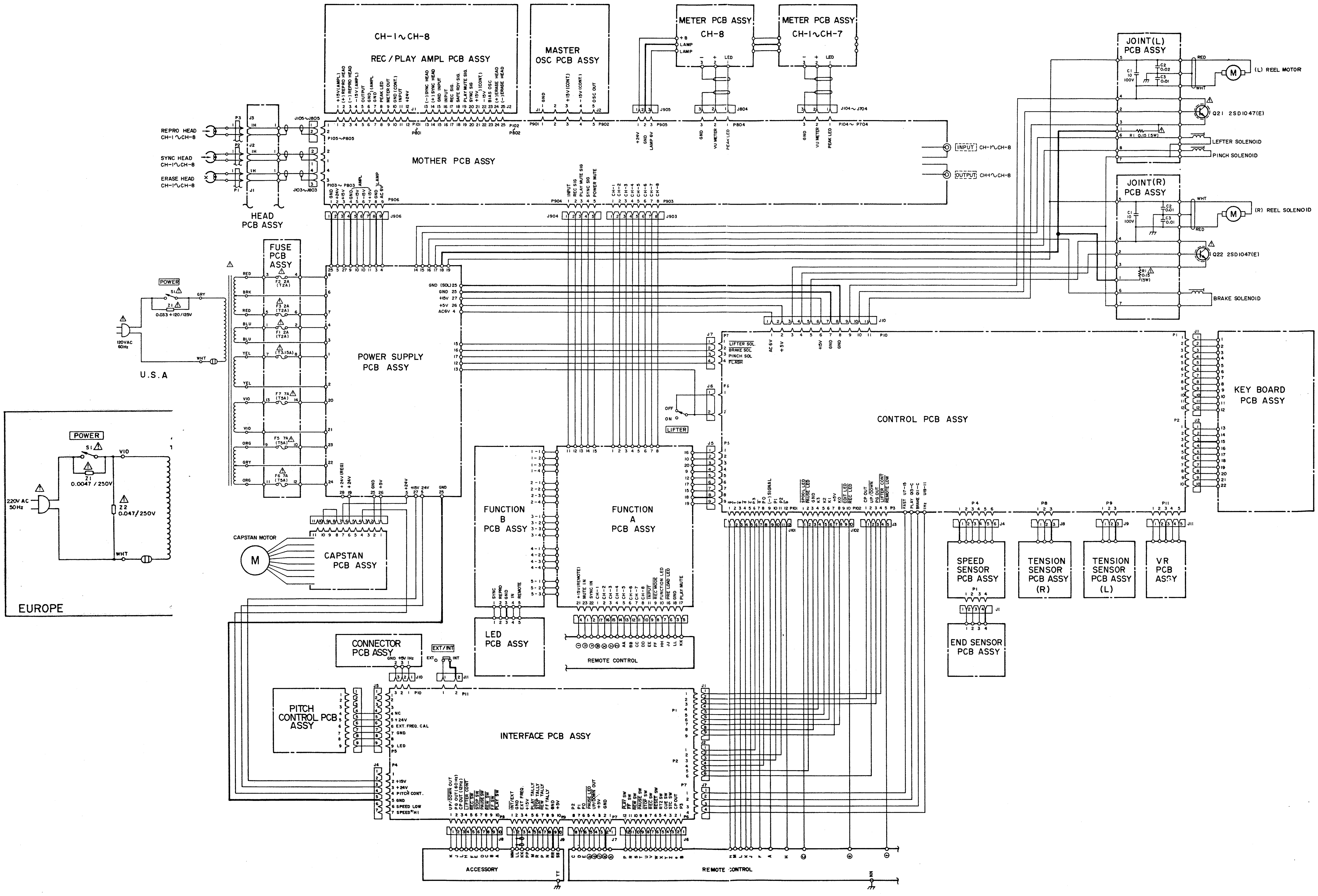
FUNCTION B PCB Ass'y (RC-51 only)

REF. NO	PARTS NO.	DESCRIPTION
	5200105300	PCB Ass'y
	5210082400	PCB
	TRANSISTORS	
Q2	5230771000	2SC2274E
Q3	5042383000	2SC536F
Q4	5042553000	2SA733P
	DIODES	
D5 ~D8	5042517000	IS2473VE
D10	5042517000	IS2473VE
D19	5224531501	RD47EBI, Zener
D20 ~D28	5042517000	IS2473VE
D29	5224531501	RD47EB1, Zener
	CARBON RESISTORS	
All resistors are rated ±5% tolerance at 1/4 watt.		
R1	5183078000	680Ω
R2	5183080000	820Ω
R3	5183092000	2.7kΩ
R9; R10	5183058000	100Ω
R11 ~R18	5183080000	820Ω
R19	5183122000	47kΩ
R20, R21	5183084000	1.2kΩ
R22	5183106000	10kΩ
R23	5183122000	47kΩ
R24	5183116000	27kΩ
R25	5183122000	47kΩ
R26	5183084000	1.2kΩ
	CAPACITORS	
C3, C4	5172882000	Elec, 1μF 50V
	MISCELLANEOUS	
S2	5300028000	Push Switch; 2-2 (3-gang)
S3, S4	5300028800	Push Switch; 2-2 (4-gang)
D11 ~D18	5225011300	LED, SLP 455B
	5122128000	Connector, Plug; 4P

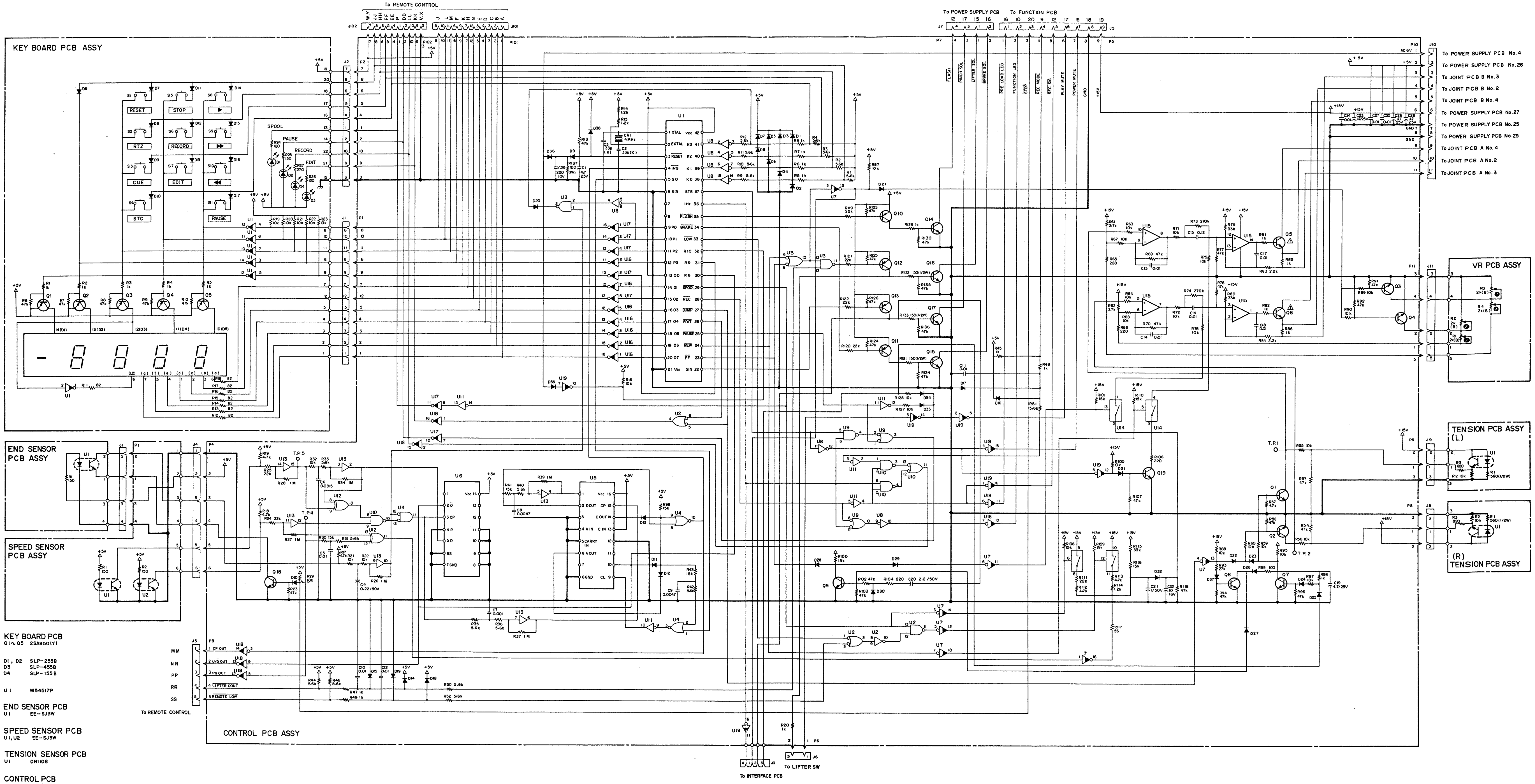
- The same Display and Switch PCB assemblies are used in both the RC-50 and RC-51.
- The LED PCB Ass'y is the same as that used in the 58, so refer to page 8-26.
- The PC boards used for both the Function A and Function B PCB assemblies are the same as those of the 58, so refer to page 8-26.
- Consequently, only the Display and Switch PCB assemblies are shown.

8-3. CIRCUIT SCHEMATICS

8-3-1. Wiring Diagram


CH-1∿CH-8
REC / PLAY AMPL PCB ASSY
MASTER
OSC PCB ASSY
METER PCB ASSY
CH-8
METER PCB ASSY
CH-1∿CH-7
JOINT(L)
PCB ASSY
(L) REEL MOTOR
Q21 2SD1047(E)
LEFTER SOLENOID
PINCH SOLENOID
JOINT(R)
PCB ASSY
(R) REEL SOLENOID
Q22 2SD1047(E)
BRAKE SOLENOID
REPRO HEAD
CH-1∿CH-8
SYNC HEAD
CH-1∿CH-8
ERASE HEAD
CH-1∿CH-8
HEAD
PCB ASSY
MOTHER PCB ASSY
INPUT CH-1∿CH-8
OUTPUT CH-1∿CH-8
FUSE
PCB
ASSY
POWER
S1
Z1
0.033 + 120/125V
120VAC
60Hz
U.S.A
GRY
WHT
POWER SUPPLY
PCB ASSY
CONTROL PCB ASSY
KEY BOARD
PCB ASSY
LIFTER SOL
BRAKE SOL
PINCH SOL
FLASH
OFF
ON
LIFTER
POWER
S1
Z1
0.0047 / 250V
Z2
0.047/250V
220V AC
50Hz
VIO
WHT
EUROPE
CAPSTAN MOTOR
M
CAPSTAN
PCB ASSY
FUNCTION
B
PCB ASSY
FUNCTION
A
PCB ASSY
LED
PCB ASSY
REMOTE CONTROL
SPEED
SENSOR
PCB ASSY
TENSION
SENSOR
PCB ASSY
(R)
TENSION
SENSOR
PCB ASSY
(L)
VR
PCB
ASSY
END SENSOR
PCB ASSY
CONNECTOR
PCB ASSY
EXT/INT
PITCH
CONTROL PCB
ASSY
INTERFACE PCB ASSY
ACCESSORY
REMOTE CONTROL

8-3-2. Control PCB Ass'y


To REMOTE CONTROL
J102
J101
KEY BOARD PCB ASSY
RESET
STOP
RTZ
RECORD
CUE
EDIT
STC
PAUSE
SPOOL
U1
END SENSOR PCB ASSY
SPEED SENSOR PCB ASSY
U6
U5
To POWER SUPPLY PCB
To FUNCTION PCB
FLASH
PINCH SOL
LIFTER SOL
BRAKE SOL
PRE LOAD LED
FUNCTION LED
STOP
REC MODE
REC SIG
PLAY MUTE
POWER MUTE
GND
To POWER SUPPLY PCB No. 4
To POWER SUPPLY PCB No. 26
To JOINT PCB B No. 3
To JOINT PCB B No. 2
To JOINT PCB B No. 4
To POWER SUPPLY PCB No. 27
To POWER SUPPLY PCB No. 25
To POWER SUPPLY PCB No. 25
To JOINT PCB A No. 4
To JOINT PCB A No. 2
To JOINT PCB A No. 3
VR PCB ASSY
TENSION PCB ASSY (L)
(R) TENSION PCB ASSY
T.P.1
T.P.2
T.P.4
T.P.5
MM
NN
PP
RR
SS
1 CP OUT
2 U/D OUT
3 PG OUT
4 LIFTER CONT
5 REMOTE LOW
To REMOTE CONTROL
CONTROL PCB ASSY
To INTERFACE PCB
To LIFTER SW

KEY BOARD PCB

Q1～Q5	2SA950(Y)
D1, D2	SLP-255B
D3	SLP-455B
D4	SLP-155B
U1	M54517P

END SENSOR PCB

U1	EE-SJ3W

SPEED SENSOR PCB

U1, U2	EE-SJ3W

TENSION SENSOR PCB

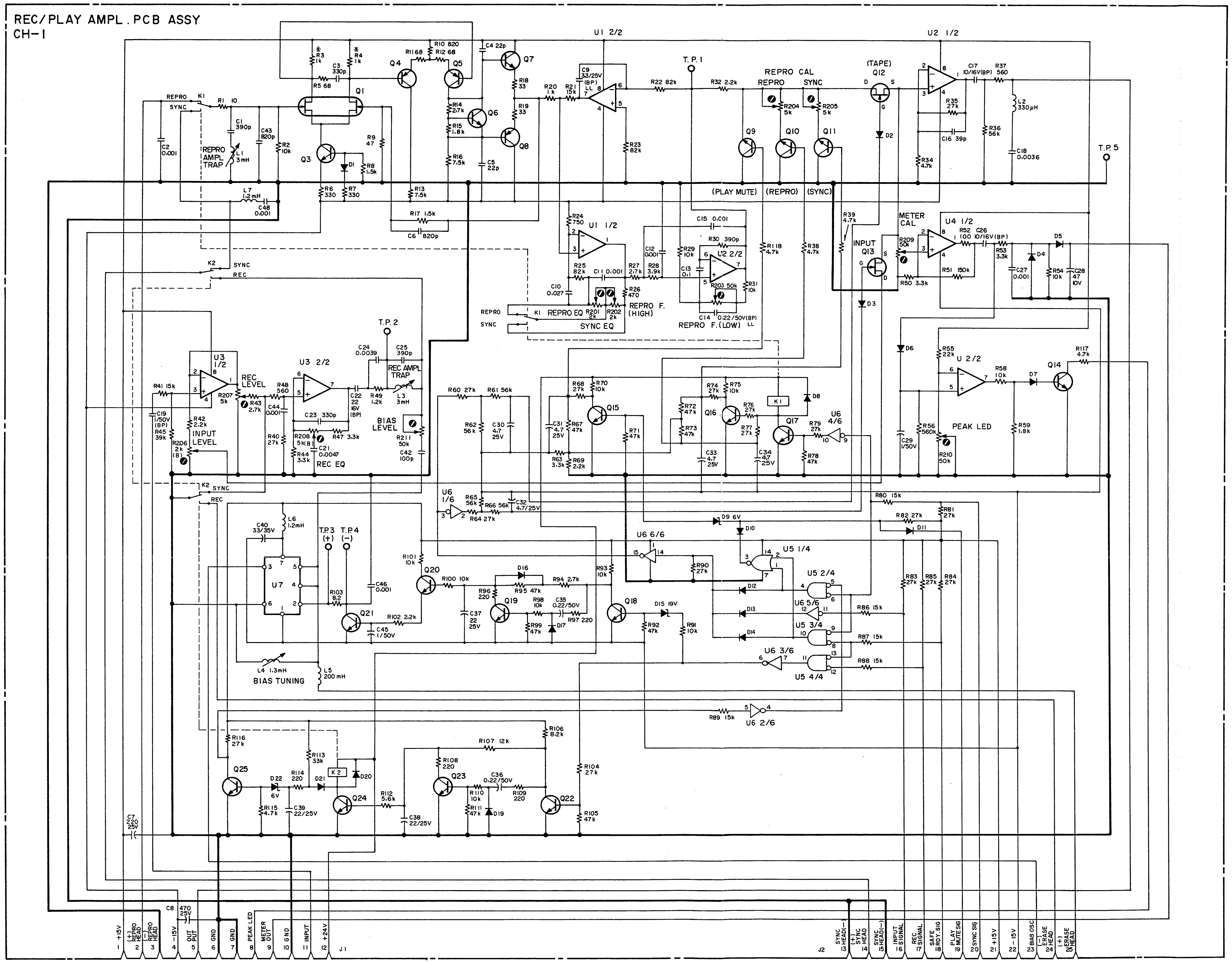
U1	ON1108

CONTROL PCB

Q1～Q4	2SC536(F)	D1～D35	1SS133(HV)	U6	TC4013BP	U13	TC4050BP
Q5, Q6	2SD600(E)	D37, D38	1SS133(HV)	U7	M54517P	U14	TC4066BP
Q7～Q9	2SC536(F)	D36	ERB12-02G1	U8	TC4049BP	U15	LM2902
Q10～Q13	2SA733(P)	U1	MB8841	U9	TC4011BP		
Q14	2SC2274	U2～U3	TC4011BP	U10	TC4011BP		
Q15～Q17	2SD313(E)	U4	TC4001BP	U11	TC4049BP		
Q18, Q19	2SC536(F)	U5	TC4510BP	U12	TC4030BP		

	C2	C3
CR1(KBR 4.0 MHz)	33p	33p
CR1(CSA 4.0 MHz)	100p	100p

8-3-3. Rec/Play Amplifier PCB Ass'y

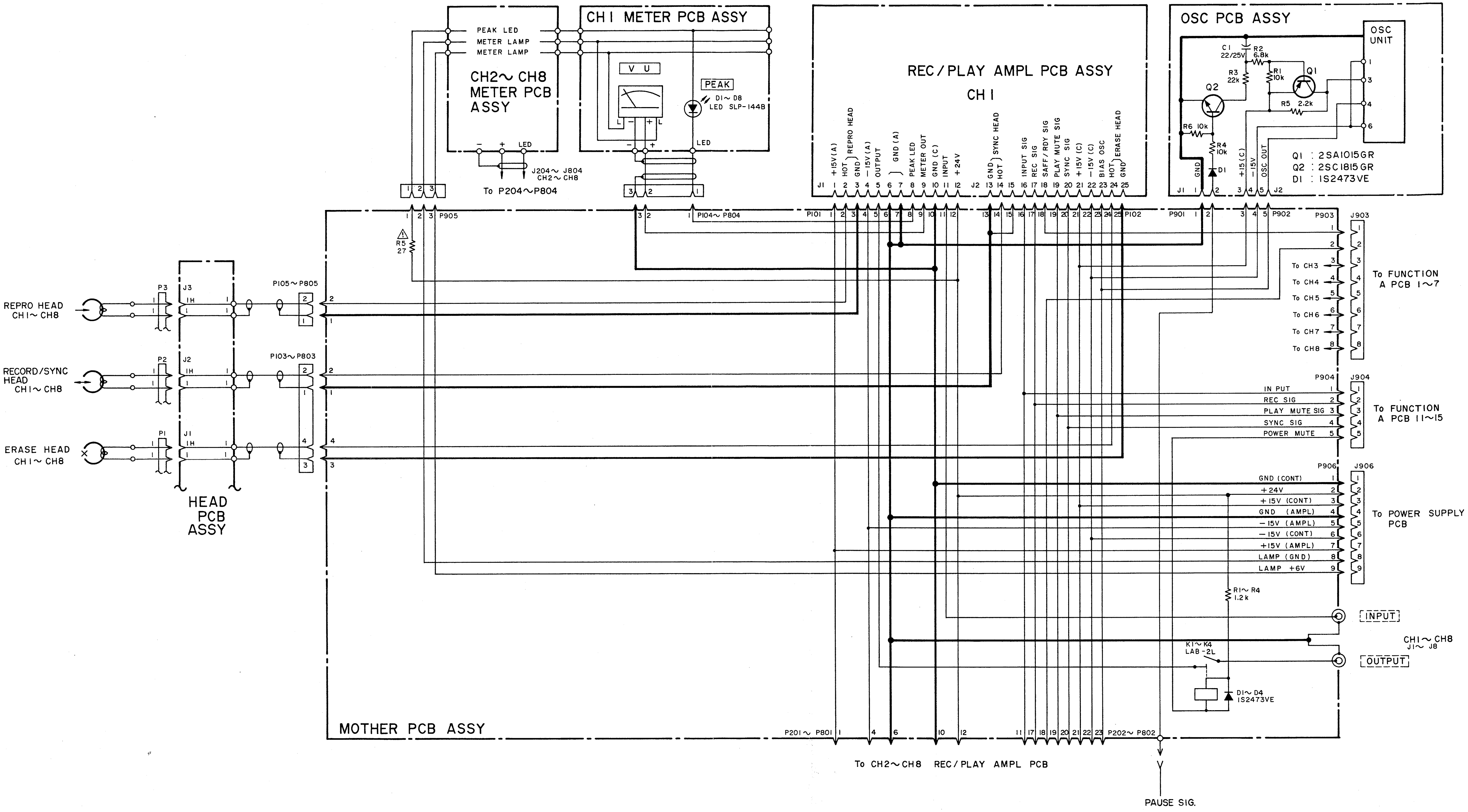

REC/PLAY AMPL. PCB ASSY
CH-1
U1 2/2
U1 1/2
U2 1/2
U2 2/2
U3 1/2
U3 2/2
U4 1/2
U 2/2
U5 1/4
U5 2/4
U5 3/4
U5 4/4
U6 1/6
U6 2/6
U6 3/6
U6 5/6
U6 6/6
U6 4/6
U7
T.P.1
T.P.2
T.P.3 (+)
T.P.4 (−)
T.P.5
REPRO CAL
REPRO
SYNC
(TAPE)
METER CAL
INPUT
(PLAY MUTE)
(REPRO)
(SYNC)
REPRO AMPL TRAP
REPRO EQ
SYNC EQ
REPRO F. (HIGH)
REPRO F. (LOW)
REC LEVEL
INPUT LEVEL
REC EQ
REC AMPL TRAP
BIAS LEVEL
BIAS TUNING
PEAK LED
K1
K2
J1
J2
+15V 1
(+) REPRO HEAD 2
(−) REPRO HEAD 3
−15V 4
OUT PUT 5
GND 6
GND 7
PEAK LED 8
METER OUT 9
GND 10
INPUT 11
+24V 12
SYNC HEAD(−) 13
(+) SYNC HEAD 14
SYNC HEAD(−) 15
INPUT SIGNAL 16
REC SIGNAL 17
SAFE RDY. SIG 18
PLAY MUTE SIG 19
SYNC SIG 20
+15V 21
−15V 22
BIAS OSC 23
(−) ERASE HEAD 24
(+) ERASE HEAD 25

To MOTHER PCB P101~P801 (CH-1~CH-8)

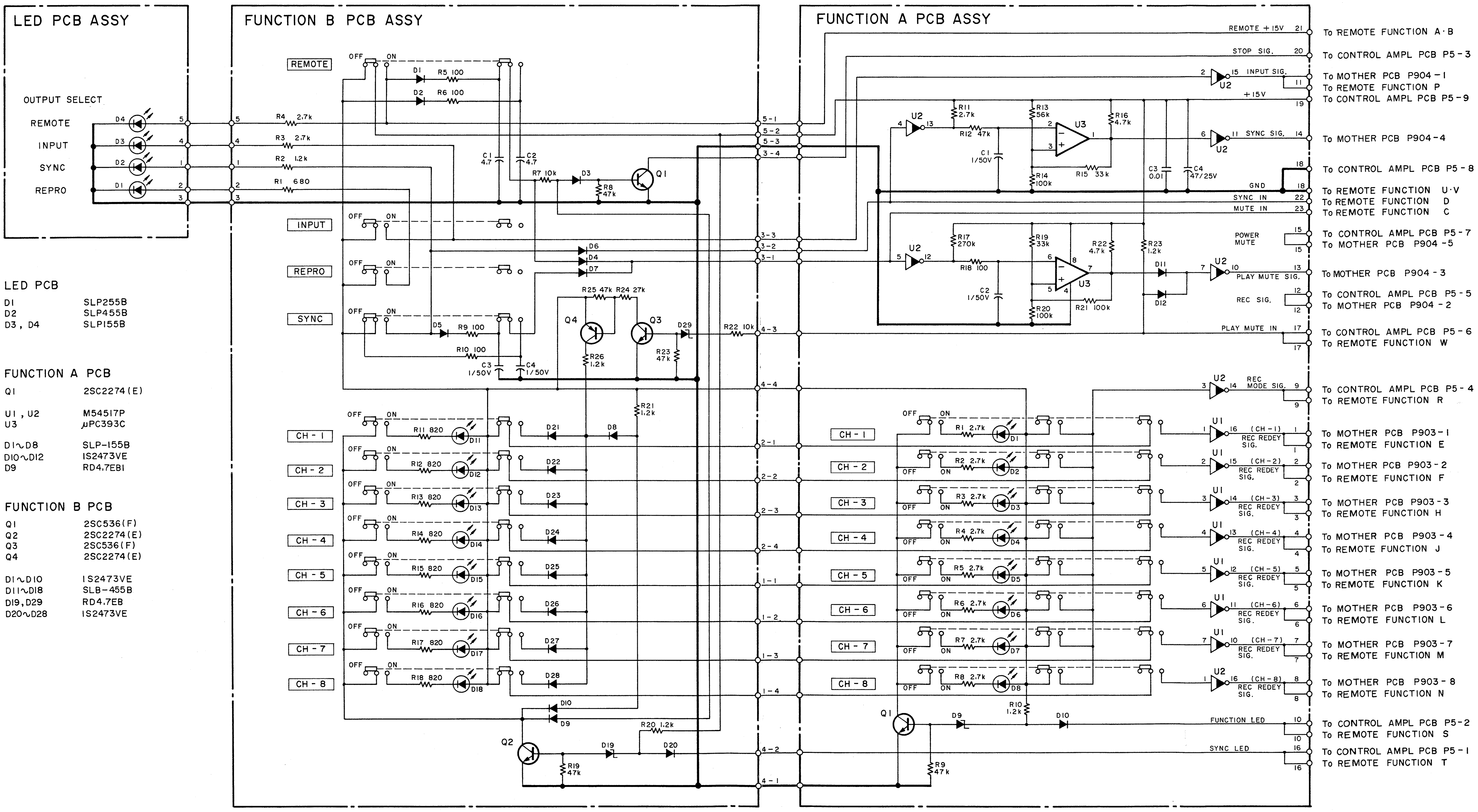
To MOTHER PCB P102~P802 (CH-1~CH-8)

Q1	2SK270BL
Q3	2SC1815GR
Q4,Q5	2SA970GR
Q6,Q7	2SC1815GR
Q8	2SA1015GR
Q9	2SD655E
Q10,Q11	2SC1815GR
Q12,Q13	2SK68AM
Q14~Q20	2SC1815GR
Q22~Q25	2SC1815GR
D1~D3	1S2473VE
D4,D5	1N60
D6~D8	1S2473VE
D9	EQA01-06S
D10~D14	1S2473VE
D15	EQA01-19R
D16,D17	1S2473VE
D19~D21	1S2473VE
D22	EQA01-06S
U1~U3	TL4558P
U4	AN6552(TL4558P)
U5	MC14001(TC14001BP)
U6	MC14049B(TC14049BP)
K1, K2	G2V-282P

8-3-4. Mother PCB Ass'y, Master Oscillator PCB Ass'y


CH1 METER PCB ASSY
CH2~ CH8 METER PCB ASSY
PEAK LED
METER LAMP
METER LAMP
V U
PEAK
D1~ D8 LED SLP-144B
LED
J204~ J804 CH2~ CH8
To P204~P804
P905
R5 27
P104~ P804
REC/PLAY AMPL PCB ASSY
CH1
J1
+15V (A)
HOT
REPRO HEAD
GND
−15V (A)
OUTPUT
GND (A)
PEAK LED
METER OUT
GND (C)
INPUT
+24V
J2
GND
HOT
SYNC HEAD
INPUT SIG
REC SIG
SAFF/RDY SIG
PLAY MUTE SIG
SYNC SIG
+15V (C)
−15V (C)
BIAS OSC
HOT
ERASE HEAD
GND
P101
P102
OSC PCB ASSY
OSC UNIT
C1 22/25V
R2 6.8k
R3 22k
R1 10k
Q1
Q2
R5 2.2k
R6 10k
R4 10k
D1
GND
+15 (C)
−15V
OSC OUT
Q1 : 2SA1015GR
Q2 : 2SC1815GR
D1 : 1S2473VE
P901
P902
P903
J903
To CH3
To CH4
To CH5
To CH6
To CH7
To CH8
To FUNCTION A PCB 1~7
P904
J904
IN PUT
REC SIG
PLAY MUTE SIG
SYNC SIG
POWER MUTE
To FUNCTION A PCB 11~15
P906
J906
GND (CONT)
+24V
+15V (CONT)
GND (AMPL)
−15V (AMPL)
−15V (CONT)
+15V (AMPL)
LAMP (GND)
LAMP +6V
To POWER SUPPLY PCB
R1~ R4 1.2k
INPUT
OUTPUT
CH1~ CH8 J1~ J8
K1~ K4 LAB-2L
D1~ D4 1S2473VE
REPRO HEAD CH1~ CH8
RECORD/SYNC HEAD CH1~ CH8
ERASE HEAD CH1~ CH8
P3
J3
P2
J2
P1
J1
1H
HEAD PCB ASSY
P105~ P805
P103~ P803
MOTHER PCB ASSY
P201~ P801
P202~ P802
To CH2~CH8 REC/PLAY AMPL PCB
PAUSE SIG.

8-3-5. Function A PCB Ass'y, Function B PCB Ass'y, LED PCB Ass'y


LED PCB ASSY
OUTPUT SELECT
REMOTE
INPUT
SYNC
REPRO
FUNCTION B PCB ASSY
REMOTE
INPUT
REPRO
SYNC
OFF
ON
CH - 1
CH - 2
CH - 3
CH - 4
CH - 5
CH - 6
CH - 7
CH - 8
R4 2.7k
R3 2.7k
R2 1.2k
R1 680
R5 100
R6 100
R7 10k
R8 47k
R9 100
R10 100
R11 820
R12 820
R13 820
R14 820
R15 820
R16 820
R17 820
R18 820
R19 47k
R20 1.2k
R21 1.2k
R22 10k
R23 47k
R24 27k
R25 47k
R26 1.2k
C1 4.7
C2 4.7
C3 1/50V
C4 1/50V
Q1
Q2
Q3
Q4
FUNCTION A PCB ASSY
REMOTE +15V
STOP SIG.
INPUT SIG.
+15V
SYNC SIG.
GND
SYNC IN
MUTE IN
POWER MUTE
PLAY MUTE SIG.
REC SIG.
PLAY MUTE IN
REC MODE SIG.
(CH-1) REC REDEY SIG.
(CH-2) REC REDEY SIG.
(CH-3) REC REDEY SIG.
(CH-4) REC REDEY SIG.
(CH-5) REC REDEY SIG.
(CH-6) REC REDEY SIG.
(CH-7) REC REDEY SIG.
(CH-8) REC REDEY SIG.
FUNCTION LED
SYNC LED
R11 2.7k
R12 47k
R13 56k
R14 100k
R15 33k
R16 4.7k
R17 270k
R18 100
R19 33k
R20 100k
R21 100k
R22 4.7k
R23 1.2k
R1 2.7k
R2 2.7k
R3 2.7k
R4 2.7k
R5 2.7k
R6 2.7k
R7 2.7k
R8 2.7k
R9 47k
R10 1.2k
C1 1/50V
C2 1/50V
C3 0.01
C4 47/25V
U1
U2
U3
To REMOTE FUNCTION A·B
To CONTROL AMPL PCB P5-3
To MOTHER PCB P904-1
To REMOTE FUNCTION P
To CONTROL AMPL PCB P5-9
To MOTHER PCB P904-4
To CONTROL AMPL PCB P5-8
To REMOTE FUNCTION U·V
To REMOTE FUNCTION D
To REMOTE FUNCTION C
To CONTROL AMPL PCB P5-7
To MOTHER PCB P904-5
To MOTHER PCB P904-3
To CONTROL AMPL PCB P5-5
To MOTHER PCB P904-2
To CONTROL AMPL PCB P5-6
To REMOTE FUNCTION W
To CONTROL AMPL PCB P5-4
To REMOTE FUNCTION R
To MOTHER PCB P903-1
To REMOTE FUNCTION E
To MOTHER PCB P903-2
To REMOTE FUNCTION F
To MOTHER PCB P903-3
To REMOTE FUNCTION H
To MOTHER PCB P903-4
To REMOTE FUNCTION J
To MOTHER PCB P903-5
To REMOTE FUNCTION K
To MOTHER PCB P903-6
To REMOTE FUNCTION L
To MOTHER PCB P903-7
To REMOTE FUNCTION M
To MOTHER PCB P903-8
To REMOTE FUNCTION N
To CONTROL AMPL PCB P5-2
To REMOTE FUNCTION S
To CONTROL AMPL PCB P5-1
To REMOTE FUNCTION T

LED PCB

D1	SLP255B
D2	SLP455B
D3, D4	SLP155B

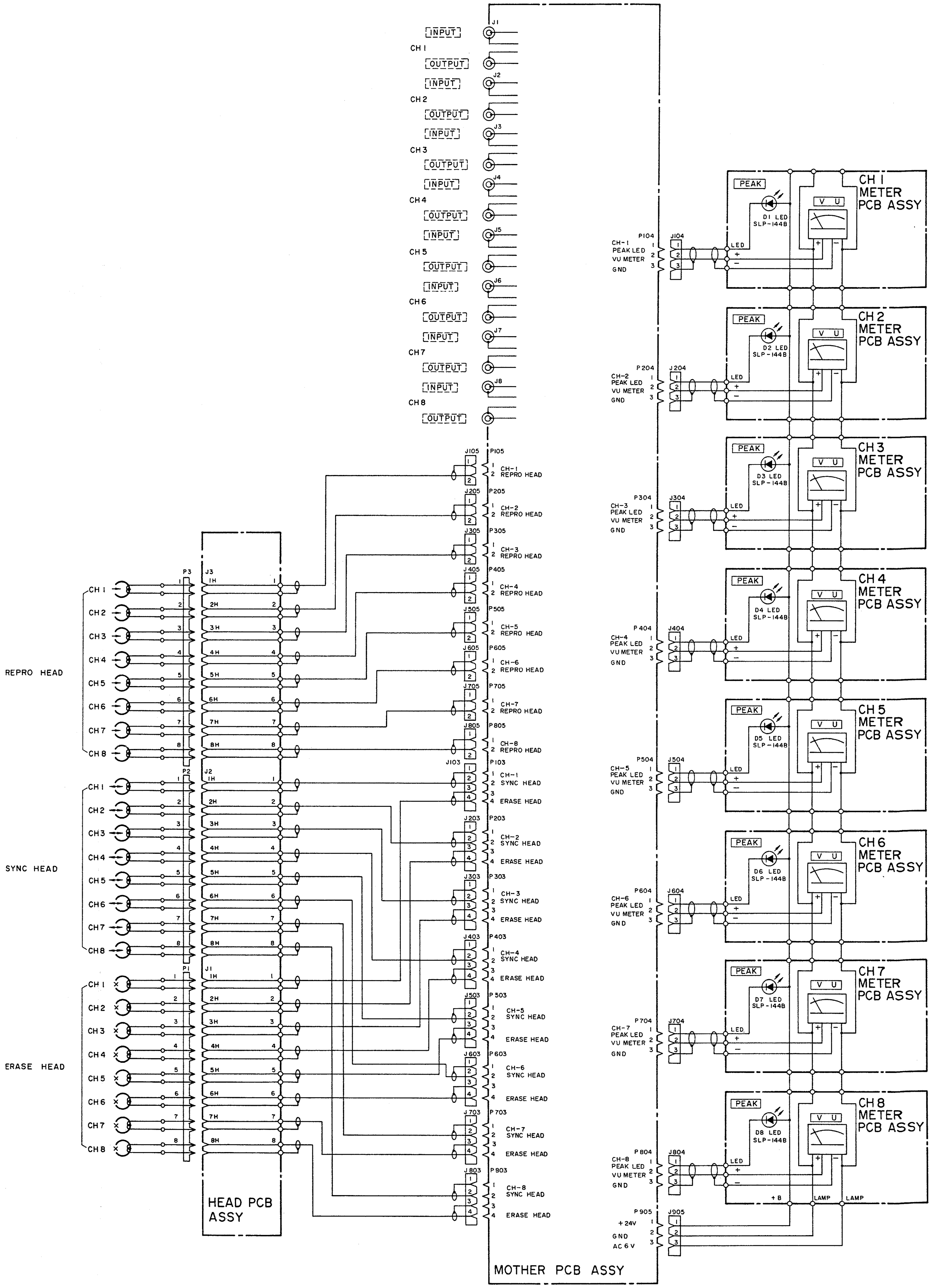
FUNCTION A PCB

Q1	2SC2274(E)
U1, U2	M54517P
U3	μPC393C
D1∿D8	SLP-155B
D10∿D12	1S2473VE
D9	RD4.7EB1

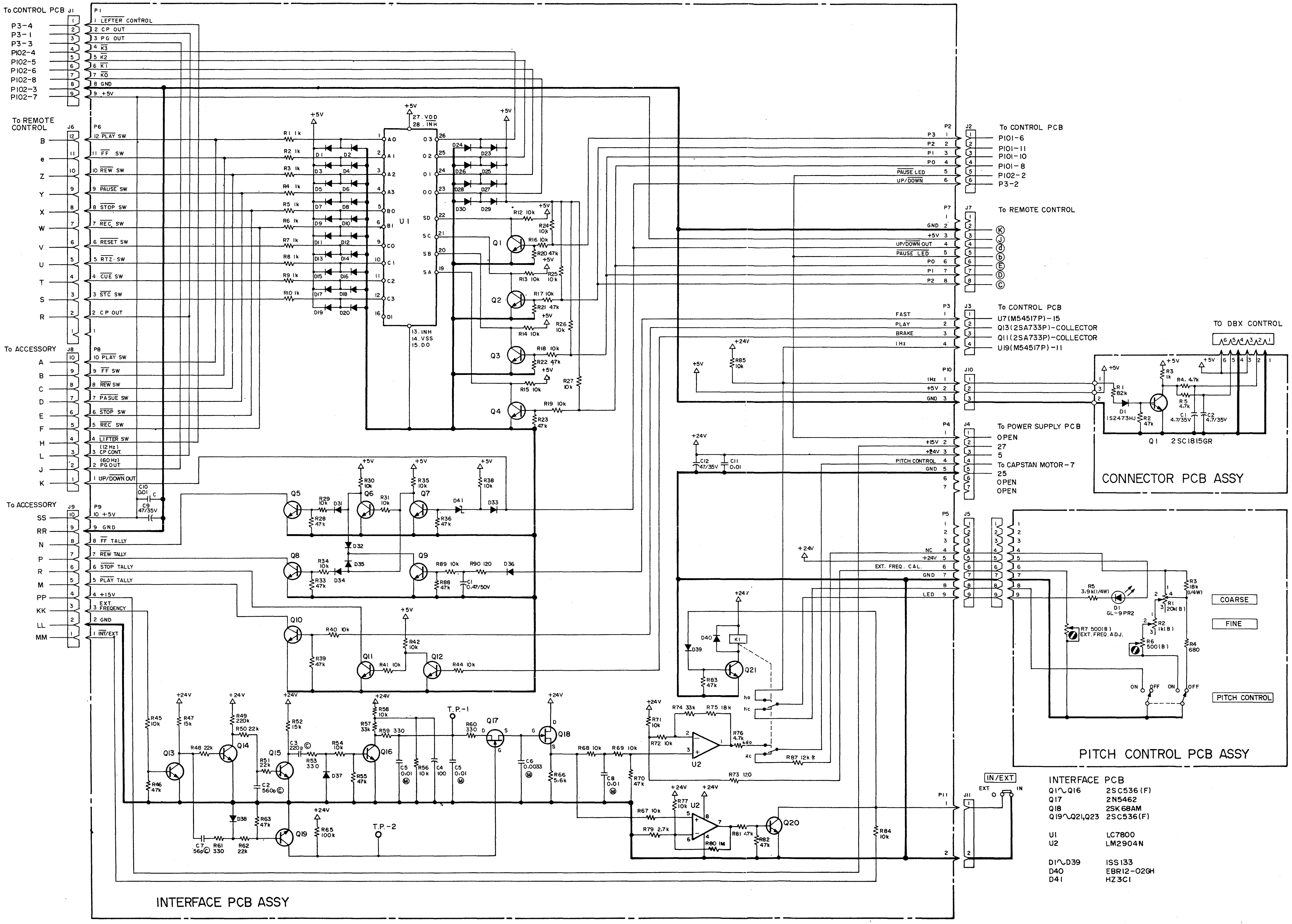
FUNCTION B PCB

Q1	2SC536(F)
Q2	2SC2274(E)
Q3	2SC536(F)
Q4	2SC2274(E)
D1∿D10	1S2473VE
D11∿D18	SLB-455B
D19, D29	RD4.7EB
D20∿D28	1S2473VE

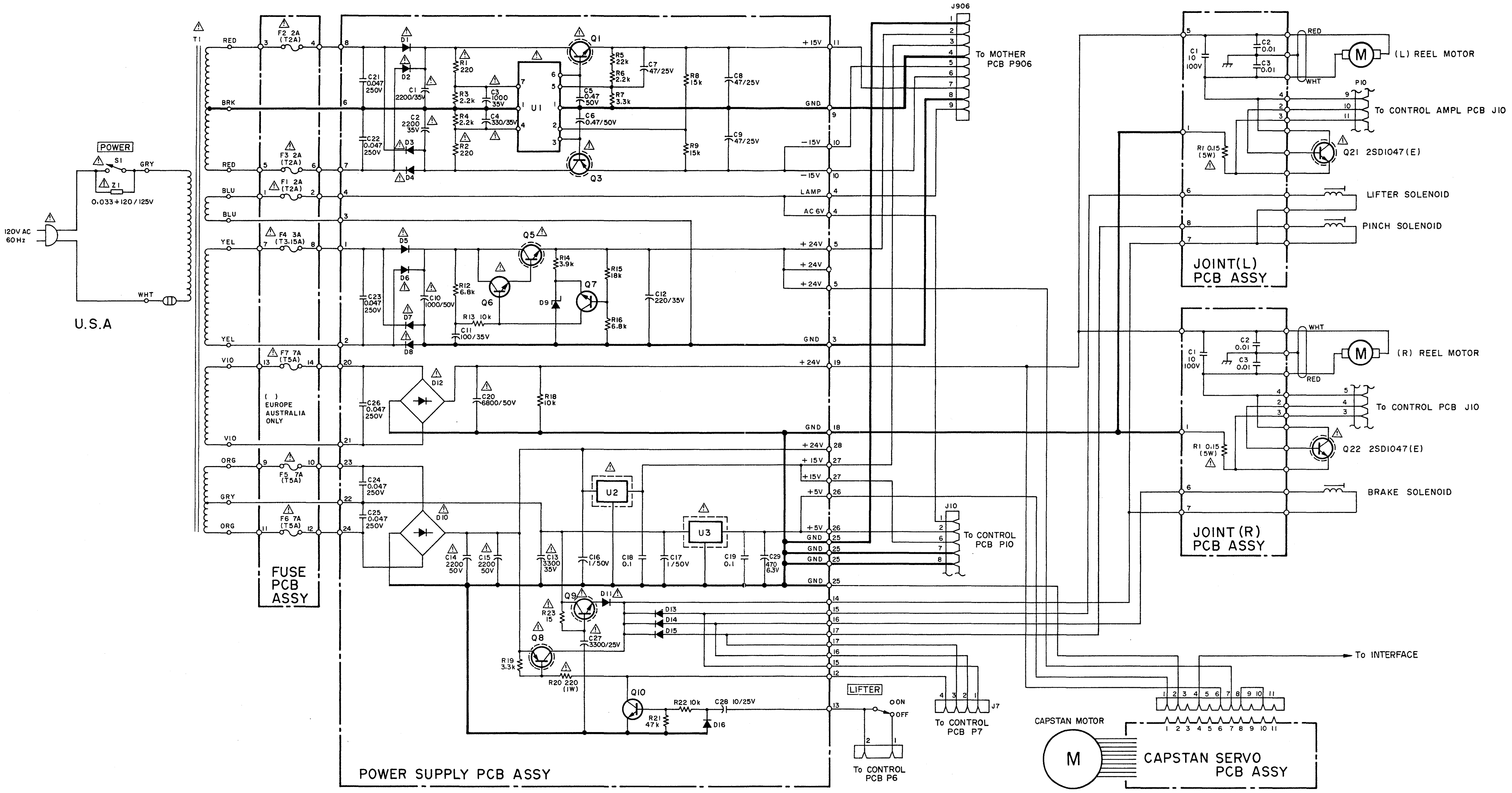
8-3-6. Meter and Head Wiring Diagram


INPUT
OUTPUT
CH 1
CH 2
CH 3
CH 4
CH 5
CH 6
CH 7
CH 8
J1
J2
J3
J4
J5
J6
J7
J8
REPRO HEAD
SYNC HEAD
ERASE HEAD
P1
P2
P3
HEAD PCB ASSY
MOTHER PCB ASSY
CH-1 REPRO HEAD
CH-1 SYNC HEAD
ERASE HEAD
CH-1 PEAK LED VU METER GND
P104
J104
PEAK
V U
D1 LED SLP-144B
LED
CH 1 METER PCB ASSY
CH 2 METER PCB ASSY
CH 3 METER PCB ASSY
CH 4 METER PCB ASSY
CH 5 METER PCB ASSY
CH 6 METER PCB ASSY
CH 7 METER PCB ASSY
CH 8 METER PCB ASSY
P905
J905
+24V
GND
AC 6 V
+B
LAMP

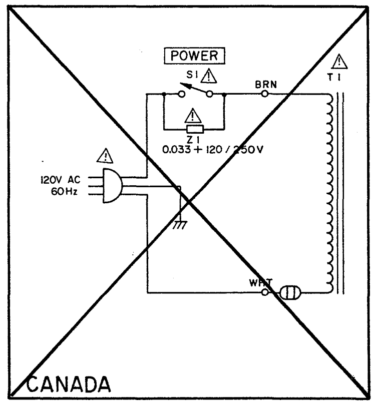
8-3-7. Interface Diagram


To CONTROL PCB J1
P3-4
P3-1
P3-3
P102-4
P102-5
P102-6
P102-8
P102-3
P102-7
P1
1 LEFTER CONTROL
2 CP OUT
3 PG OUT
4 K3
5 K2
6 K1
7 K0
8 GND
9 +5V
To REMOTE CONTROL J6
P6
12 PLAY SW
11 FF SW
10 REW SW
9 PAUSE SW
8 STOP SW
7 REC SW
6 RESET SW
5 RTZ SW
4 CUE SW
3 STC SW
2 CP OUT
To ACCESSORY J8
P8
10 PLAY SW
9 FF SW
8 REW SW
7 PAUSE SW
6 STOP SW
5 REC SW
4 LIFTER SW
3 (12Hz) CP CONT.
2 (60Hz) PG OUT
1 UP/DOWN OUT
To ACCESSORY J9
P9
10 +5V
9 GND
8 FF TALLY
7 REW TALLY
6 STOP TALLY
5 PLAY TALLY
4 +15V
3 EXT. FREQUENCY
2 GND
1 INT/EXT
U1
27 VDD
28 INH
13 INH
14 VSS
15 DO
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
Q19
Q20
Q21
U2
K1
T.P.-1
T.P.-2
P2
P3 1
P2 2
P1 3
P0 4
PAUSE LED 5
UP/DOWN 6
J2
To CONTROL PCB
P101-6
P101-11
P101-10
P101-8
P102-2
P3-2
P7
GND 2
+5V 3
UP/DOWN OUT 4
PAUSE LED 5
P0 6
P1 7
P2 8
J7
To REMOTE CONTROL
Ⓚ
Ⓙ
ⓓ
ⓑ
Ⓔ
Ⓓ
Ⓒ
P3
FAST 1
PLAY 2
BRAKE 3
1Hz 4
J3
To CONTROL PCB
U7(M54517P)-15
Q13(2SA733P)-COLLECTOR
Q11(2SA733P)-COLLECTOR
U19(M54517P)-11
P10
1Hz 1
+5V 2
GND 3
J10
TO DBX CONTROL
CONNECTOR PCB ASSY
Q1 2SC1815GR
D1 1S2473HJ
P4
+15V 2
+24V 3
PITCH CONTROL 4
GND 5
J4
To POWER SUPPLY PCB
OPEN
27
5
To CAPSTAN MOTOR-7
25
OPEN
OPEN
P5
NC 4
+24V 5
EXT. FREQ. CAL. 6
GND 7
LED 9
J5
D1 GL-9PR2
R7 500(B) EXT. FREQ. ADJ.
COARSE
FINE
PITCH CONTROL
ON
OFF
PITCH CONTROL PCB ASSY
P11
J11
IN/EXT
EXT
IN
INTERFACE PCB ASSY
INTERFACE PCB
Q1~Q16 2SC536(F)
Q17 2N5462
Q18 2SK68AM
Q19~Q21,Q23 2SC536(F)
U1 LC7800
U2 LM2904N
D1~D39 1SS133
D40 EBR12-02GH
D41 HZ3C1

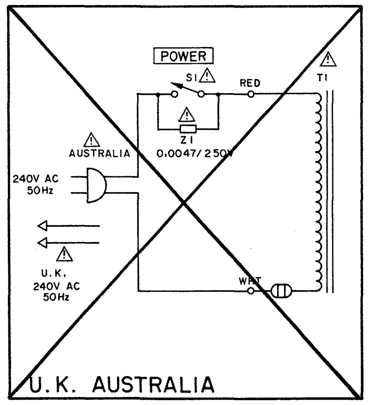
8-3-8. Power Supply PCB Ass'y



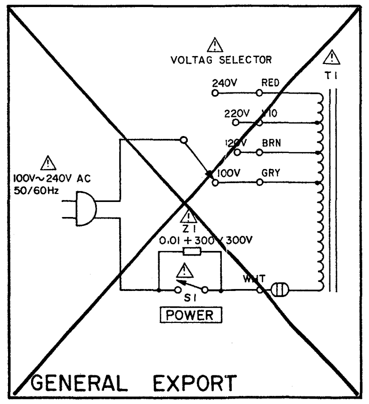
U.S.A
120V AC 60Hz
POWER
S1
Z1
0.033+120/125V
GRY
WHT
T1
RED
BRK
BLU
YEL
V10
ORG
F2 2A (T2A)
F3 2A (T2A)
F1 2A (T2A)
F4 3A (T3.15A)
F7 7A (T5A)
( ) EUROPE AUSTRALIA ONLY
F5 7A (T5A)
F6 7A (T5A)
FUSE PCB ASSY
Q1
Q3
Q5
Q6
Q7
Q8
Q9
Q10
U1
U2
U3
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
C21 0.047 250V
C22 0.047 250V
C1 2200/35V
C2 2200 35V
C3 1000 35V
C4 330/35V
C5 0.47 50V
C6 0.47/50V
C7 47/25V
C8 47/25V
C9 47/25V
R1 220
R2 220
R3 2.2k
R4 2.2k
R5 22k
R6 2.2k
R7 3.3k
R8 15k
R9 15k
C23 0.047 250V
C10 1000/50V
R12 6.8k
R13 10k
C11 100/35V
R14 3.9k
R15 18k
R16 6.8k
C12 220/35V
C26 0.047 250V
C20 6800/50V
R18 10k
C24 0.047 250V
C25 0.047 250V
C14 2200 50V
C15 2200 50V
C13 3300 35V
C16 1/50V
C18 0.1
C17 1/50V
C19 0.1
C29 470 6.3V
R23 15
C27 3300/25V
R19 3.3k
R20 220 (1W)
R22 10k
C28 10/25V
R21 47k
+15V
GND
-15V
LAMP
AC 6V
+24V
+5V
J906
To MOTHER PCB P906
J10
To CONTROL PCB P10
LIFTER
ON
OFF
To CONTROL PCB P6
To CONTROL PCB P7
J7
POWER SUPPLY PCB ASSY
C1 10 100V
C2 0.01
C3 0.01
RED
WHT
(L) REEL MOTOR
P10
To CONTROL AMPL PCB J10
R1 0.15 (5W)
Q21 2SD1047(E)
LIFTER SOLENOID
PINCH SOLENOID
JOINT(L) PCB ASSY
(R) REEL MOTOR
To CONTROL PCB J10
Q22 2SD1047(E)
BRAKE SOLENOID
JOINT (R) PCB ASSY
To INTERFACE
CAPSTAN MOTOR
M
CAPSTAN SERVO PCB ASSY



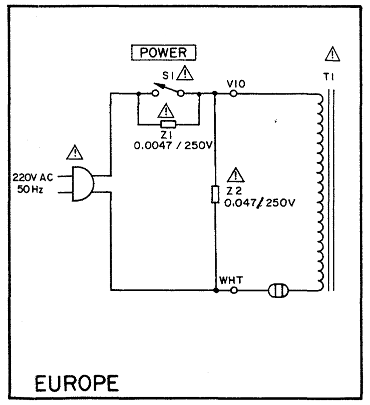
POWER
S1
BRN
T1
Z1
0.033+120/250V
120V AC 60Hz
WHT
CANADA



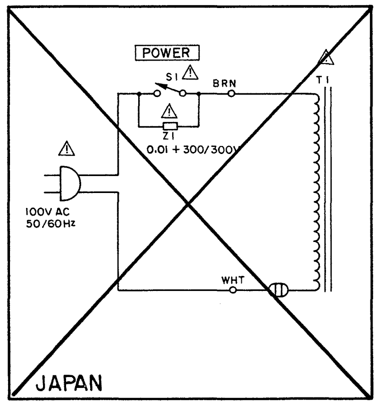
POWER
S1
RED
T1
Z1
0.0047/250V
AUSTRALIA
240V AC 50Hz
U.K. 240V AC 50Hz
WHT
U.K. AUSTRALIA



VOLTAG SELECTOR
T1
240V
RED
220V
V10
120V
BRN
100V
GRY
100V~240V AC 50/60Hz
Z1
0.01+300/300V
S1
POWER
WHT
GENERAL EXPORT



POWER
S1
V10
T1
Z1
0.0047/250V
Z2
0.047/250V
220V AC 50Hz
WHT
EUROPE

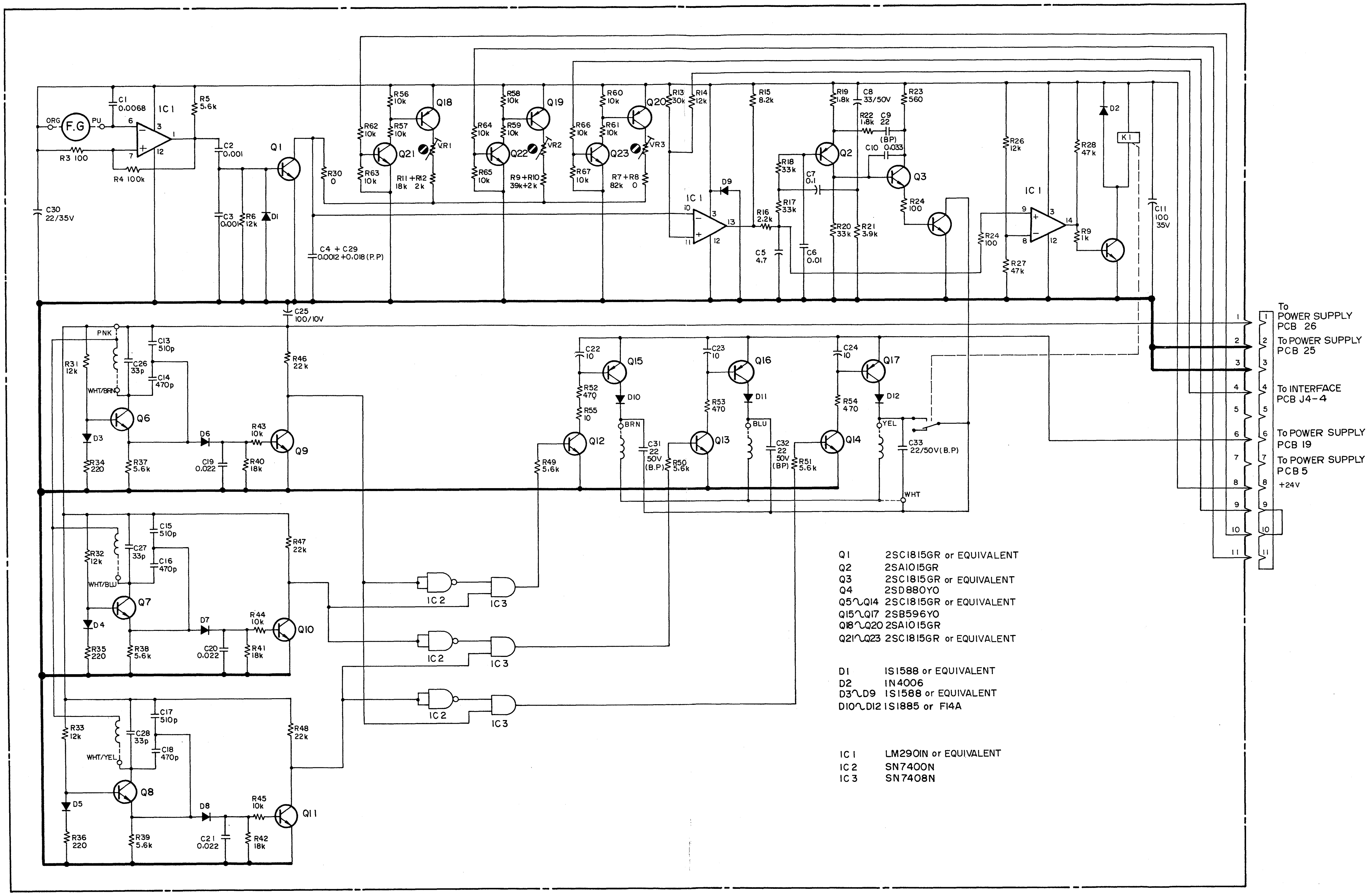


POWER
S1
BRN
T1
Z1
0.01+300/300V
100V AC 50/60Hz
WHT
JAPAN

POWER SUPPLY PCB.

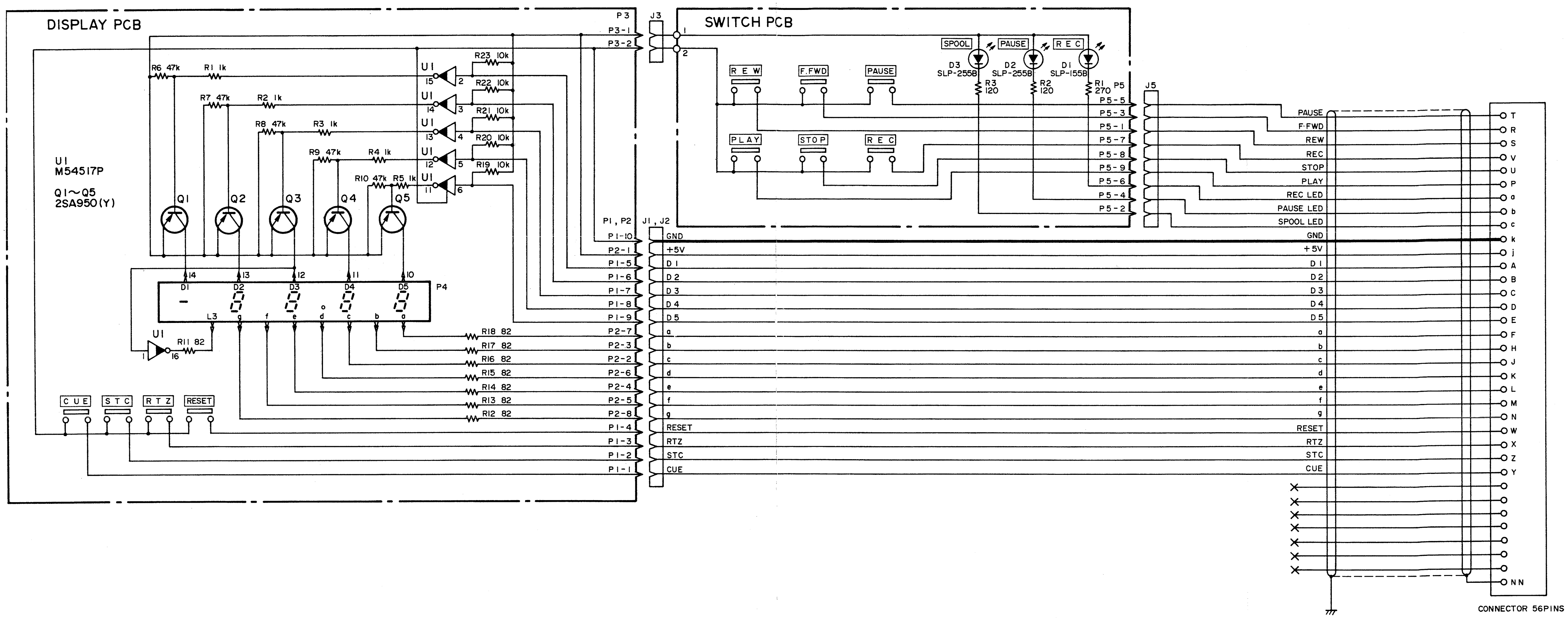
Q1	2SD313(E)
Q3	2SB507(E)
Q5	2SD313(E)
Q6	2SC2274(K)
Q7	2SC536(F)
Q8	2SB507(E)
Q9	
Q10	2SC2274
D9	EQA01-065
D10	D5FB20
D11	S3U20H
D12	D5FB20
D13~D15	
D16	1S2473VE
U1	M5230L
U2	7815
U3	7805

8-3-9. Capstan Motor PCB Ass'y (for graphic purposes only)

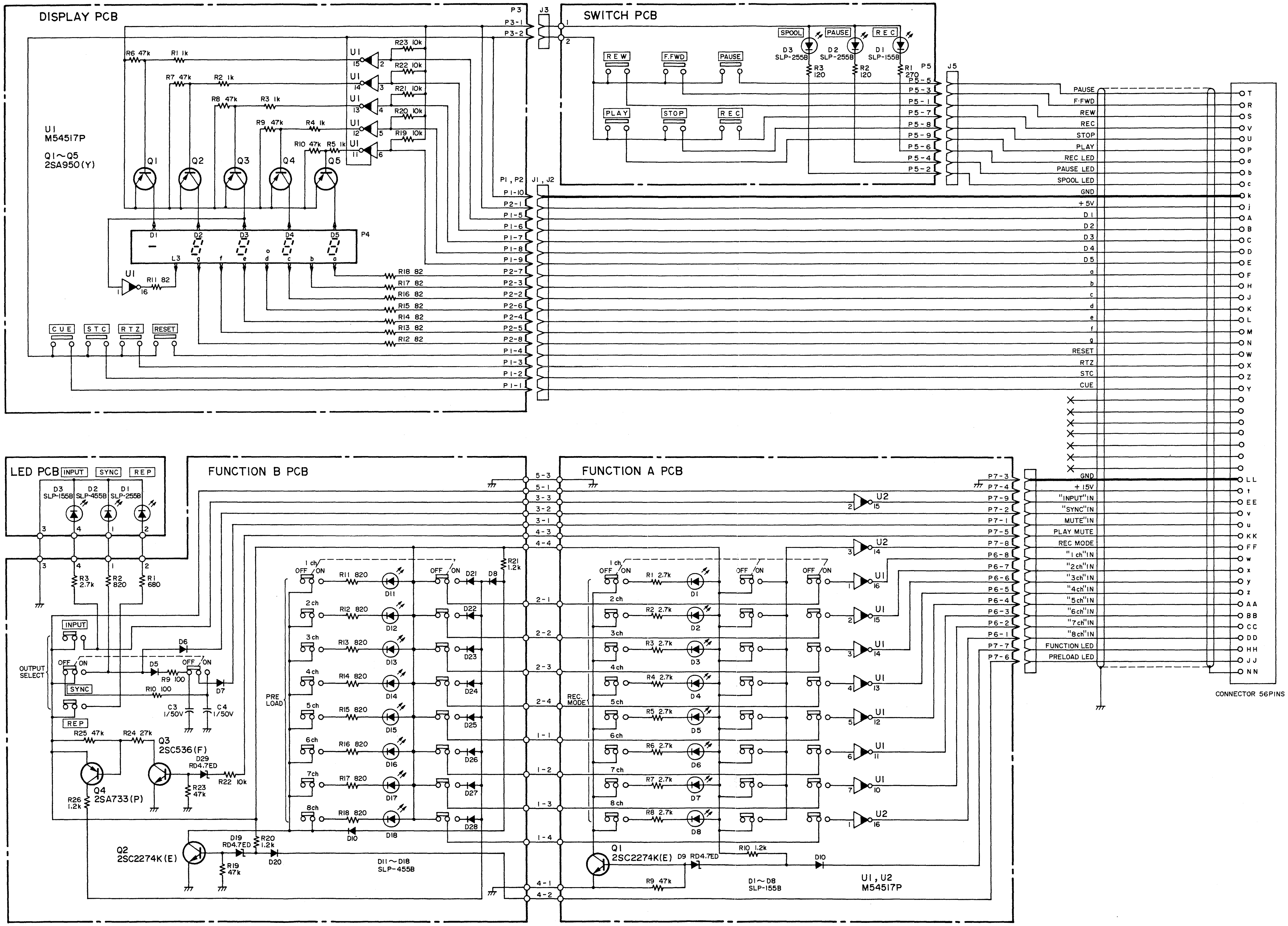

F.G
ORG
PU
IC1
C1 0.0068
R3 100
R4 100k
R5 5.6k
C2 0.001
C3 0.001
R6 12k
D1
Q1
R30 0
C4 + C29 0.0012 +0.018 (P.P)
C30 22/35V
C25 100/10V
R56 10k
R57 10k
R62 10k
R63 10k
Q18
Q21
VR1
R11 +R12 18k 2k
R58 10k
R59 10k
R64 10k
R65 10k
Q19
Q22
VR2
R9+R10 39k+2k
R60 10k
R61 10k
R66 10k
R67 10k
Q20
Q23
VR3
R7 +R8 82k 0
R13 30k
R14 12k
D9
R15 8.2k
R16 2.2k
R17 33k
R18 33k
C5 4.7
C6 0.01
C7 0.1
R19 1.8k
C8 33/50V
R22 1.8k
C9 22 (BP)
C10 0.033
R23 560
Q2
Q3
R20 33k
R21 3.9k
R24 100
R26 12k
R27 47k
R28 47k
R9 1k
D2
K1
C11 100 35V
PNK
R31 12k
C13 510p
C26 33p
C14 470p
WHT/BRN
Q6
D3
R34 220
R37 5.6k
D6
C19 0.022
R43 10k
R40 18k
Q9
R46 22k
R32 12k
C15 510p
C27 33p
C16 470p
WHT/BLU
Q7
D4
R35 220
R38 5.6k
D7
C20 0.022
R44 10k
R41 18k
Q10
R47 22k
R33 12k
C17 510p
C28 33p
C18 470p
WHT/YEL
Q8
D5
R36 220
R39 5.6k
D8
C21 0.022
R45 10k
R42 18k
Q11
R48 22k
IC2
IC3
C22 10
Q15
R52 470
R55 10
D10
BRN
Q12
R49 5.6k
C31 22 50V (B.P)
R50 5.6k
C23 10
Q16
R53 470
D11
BLU
Q13
C32 22 50V (BP)
R51 5.6k
C24 10
Q17
R54 470
D12
YEL
Q14
C33 22/50V(B.P)
WHT
To POWER SUPPLY PCB 26
To POWER SUPPLY PCB 25
To INTERFACE PCB J4-4
To POWER SUPPLY PCB 19
To POWER SUPPLY PCB5
+24V
1
2
3
4
5
6
7
8
9
10
11

Q1	2SC1815GR or EQUIVALENT
Q2	2SA1015GR
Q3	2SC1815GR or EQUIVALENT
Q4	2SD880YO
Q5〜Q14	2SC1815GR or EQUIVALENT
Q15〜Q17	2SB596YO
Q18〜Q20	2SA1015GR
Q21〜Q23	2SC1815GR or EQUIVALENT
D1	IS1588 or EQUIVALENT
D2	IN4006
D3〜D9	IS1588 or EQUIVALENT
D10〜D12	IS1885 or F14A
IC1	LM2901N or EQUIVALENT
IC2	SN7400N
IC3	SN7408N

8-3-10 Remote Control Unit, RC-50


DISPLAY PCB
SWITCH PCB
U1
M54517P
Q1~Q5
2SA950(Y)
R6 47k
R1 1k
R7 47k
R2 1k
R8 47k
R3 1k
R9 47k
R4 1k
R10 47k
R5 1k
R23 10k
R22 10k
R21 10k
R20 10k
R19 10k
R11 82
R18 82
R17 82
R16 82
R15 82
R14 82
R13 82
R12 82
Q1
Q2
Q3
Q4
Q5
D1
D2
D3
D4
D5
P4
L3
CUE
STC
RTZ
RESET
P3
P3-1
P3-2
J3
P1, P2
J1, J2
P1-10
P2-1
P1-5
P1-6
P1-7
P1-8
P1-9
P2-7
P2-3
P2-2
P2-6
P2-4
P2-5
P2-8
P1-4
P1-3
P1-2
P1-1
GND
+5V
RESET
RTZ
STC
CUE
REW
F.FWD
PAUSE
PLAY
STOP
REC
SPOOL
D3
SLP-255B
D2
SLP-255B
D1
SLP-155B
R3
120
R2
120
R1
270
P5
J5
P5-5
P5-3
P5-1
P5-7
P5-8
P5-9
P5-6
P5-4
P5-2
REC LED
PAUSE LED
SPOOL LED
T
R
S
V
U
P
a
b
c
k
j
A
B
C
D
E
F
H
J
K
L
M
N
W
X
Z
Y
NN
CONNECTOR 56PINS

8-3-11 Remote Control Unit, RC-51


DISPLAY PCB
SWITCH PCB
LED PCB
FUNCTION B PCB
FUNCTION A PCB
U1 M54517P
Q1~Q5 2SA950(Y)
CUE
STC
RTZ
RESET
REW
F.FWD
PAUSE
PLAY
STOP
REC
SPOOL
D3 SLP-255B
D2 SLP-255B
D1 SLP-155B
INPUT
SYNC
REP
OUTPUT SELECT
PRE LOAD
REC MODE
Q3 2SC536(F)
Q4 2SA733(P)
Q2 2SC2274K(E)
Q1 2SC2274K(E)
D11~D18 SLP-455B
D1~D8 SLP-155B
U1, U2 M54517P
PAUSE
F.FWD
REW
REC
STOP
PLAY
REC LED
PAUSE LED
SPOOL LED
GND
+5V
RESET
RTZ
STC
CUE
+15V
"INPUT"IN
"SYNC"IN
MUTE"IN
PLAY MUTE
REC MODE
"1ch"IN
"2ch"IN
"3ch"IN
"4ch"IN
"5ch"IN
"6ch"IN
"7ch"IN
"8ch"IN
FUNCTION LED
PRELOAD LED
CONNECTOR 56PINS